EXCAVATIONS
AT
RAKHIGARHI
[1997-98 to 1999-2000]



Dr. Amarendra Nath

प्रत्नकीर्तिमपावृणु

Archaeological Survey of India

DR. AMARENDRA NATH
Former Director (Archaeology) ASI

RAKHIGARHI EXCAVATION
Report Writing Unit
O/o Superintending Archaeologist
ASI, Excavation Branch-II,
Purana Qila, New Delhi, 110001

Dear Dr. Tewari,

Date: 31.12.2014

Please refer to your D.O. No. 24/1/2014-EE Dated 5th June, 2014 regarding report writing on the excavations at Rakhigarhi. As desired, I am enclosing a draft report on the excavations at Rakhigarhi drawn on the lines of the "*Wheeler Committee Report-1965*".

The report highlights the facts of excavations, its objective, the site and its environment, site catchment analysis, cultural stratigraphy, structural remains, burials, graffiti, ceramics, terracotta, copper, other finds with two appendices.

I am aware of the fact that the report under submission is incomplete in its presentation in terms modern inputs required in an archaeological report. You may be aware of the fact that the ground staff available to this section is too meagre to cope up the work of report writing. The services of only one semiskilled casual labour engaged to this section has been withdrawn vide F. No. 9/66/2014-15/EB-II496 Dated 01.12.2014. The Assistant Archaeologist who is holding the charge antiquities and records of Rakhigarhi is available only when he is free from his office duty in the Branch. The services of a darftsman accorded to this unit are hardly available.

Under the circumstances it is requested to restore the services of one semiskilled casual labour earlier attached to this unit and draftsman of the Excavation Branch II Purana Quila so as to enable the unit to function smoothly with limited hands and achieve the target. Necessary instructions may kindly be issued at your level for restoring the same.

With regards

Your's Sincerely,

Enclosure: as above

(Dr. Amarendra Nath)

Dr. Rakesh Tewari
Director General
Archaeological Survey of India
New Delhi- 110011

Copy to the Superintending Archaeologist , ASI, Excavation Branch-II, Purana Qila, New Delhi, 110001 in response to his letter F.No. 9/66/2014-15/EB-382 Dated: 15.10.2014, and with a request to restore the services of semiskilled casual labour engaged earlier for the report writing work.

(Dr. Amarendra Nath)

Contents

Chapter 1

INTRODUCTION

The present report unfolds discovery of the earliest civilization of South Asia that flourished at Rakhigarhi, Haryana India during the fourth- third millennium B.C. The cultural milieu typifying the civilization was first reported in the Indus plains at Harappa (1921) followed by Mohenjodaro (1923), subsequent fieldwork witnessed the distribution of these sites in parts of Punjab, Sindh, Baluchistan and Gujarat.

After the partition in the subcontinent into two independent republics of India and Pakistan, majority of the Indus sites fell in the political territories of Pakistan, leaving Kotla Nihang Khan, Roper on the Satluj and Rangpur on the Bhadar in Kathiawad within the territory of the India. Thereafter, substantial explorations were carried out to trace the signs Indus civilization in the borderlands of Punjab, Haryana, Rajasthan and Gujarat. Continuous efforts have brought to light large number of sites on the one hand in the Saraswati- Ghaggar-Hakra- Drishadvati valley and in the upper reaches of the Yamuna- Hindon divide, besides Gujarat and upper reaches of the Godavari in Maharashtra. In view of the above distribution pattern of the sites, scholars may argue the nomenclatures 'Indus Valley' given to this cultural milieu in the light of discovery larger number of on plains of the Sarasvati -Ghaggar-Hakra-Drishadvati. Without debating the issue here it is preferred to identify the cultural components after the type site: Harappa (i.e. Harappan Civilization) as is understood by majority of scholars working in the field. Now the signature of the Harappan Civilization in extended over a vast area covering the northwestern part of the subcontinent. It extends in the north- Manda in lower Jammu and Kashmir and Shortughai in upper Afghanistan, in the south to Daimabad covering more than 1600 km, in the east Alamgirpur and in the west to Sutkaghar Doe covering more than 1600 km. It may not be out of place to record that the area covered by the Harappan Civilization is more than that of the contemporary civilization of Egypt and Mesopotamia.[1]

Apart from following the term 'Harappan Civilization' the term Pre-Harappan attributed to the cultural components of Period I at Kot Diji, Kalibanagan and Sothi-Siswal has been replaced with 'Early Harappan'. The term Early

[1] B.B. Lal, The Earliest Civilization of South Asia, New Delhi 1997, p.4

Harappan has further been sub-classified as formative urbanism and pre-formative urbanism wherein urbanism at that point of time was incubation.

Past Endeavours

Among the recorded past endeavors to an Indus civilization site- though not recognized then as such- is accredited to Charls Masson, who in 1826 saw at Harappa ruinous brick castle having remarkably high walls and towers spoiled by the ravage of time and decay.[2] Like Masson, conspicuously, James Tod, while describing the antiquities of the erstwhile Bikaner state has reported Kalibanagan (Kalibeng) along with other sites located on its northern periphery. However, in the years to follow the antiquities of Harappa continued to remain in limelight.[3] Alexander Burnes also witnessed the ruined castle on the river-side of the Harappa Town.[4] The archaeological survey carried out by Alexander Cunningham at Harappa in 1853 and 1856 reported extensive mound along the banks of Ravi. His excavations at the site among other antiquities reported a recognizable Harappan seal depicting bull and six characters. The bull over it was described outlandish origin, while the characters read: Lachhmiva in 'archaic Indian letters of an early age as Buddha himself.[5] In 1886 more seals were reported at the site,[6] which in 1712 a corpus of them was also published.[7]

Eventually, in 1920 and 1921 exploratory trenching at Harappa by Daya Ram Sahani,[8] and at Mohenjodaro by R.D. Banerji yielding identical finds together with exotic seals, the sites came to be identified as the repository of a forgotten civilization. Marshall announced that the finds of these two widely separated sites distinct from anything previously known in India and took antiquity of Indian Civilization to 3000 years earlier.[9] The distinct cultural entity of the Indus valley civilization could be realized only after horizontal excavations conducted by Vats at Harappa[10] and Marshall at Mohenjodaro.[11] Mohenjodaro was further subjected to

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[2] Charles Masson, *A Narrative of various Journeys in Baluchistan, Afganistan and the Punjab*, London, 1842, Vol. I, p.452.
[3] James Tod, *Annals and Antiquities of Rajasthan: the Central and Western Rajput States of India*, 2 vols. London 1829-32.
[4] Alexander Burnes, *Travels into Bokhara*, London 1834, Vol.III, p.137.
[5] Alexander Cunningham, *Archaeological Survey of India, Report for the Year 1872-73*, Calcutta, 1875, pp.105-108, Pl.XXXIIII.
[6] M. Dames ' Old Seals found at Harappa', *Indian Antiquary*, 1886, 15, p.1
[7] J.F.Fleet, Seals from Harappa' *Journal of Royal Asiatic Society*, 1912, pp.-669-670.
[8] Dayaram Sahani 'Excavations at Harappa' Annual Progress Report of the Superintending, Hindu and Buddhist Monuments, Northern Circle, Lahore, 1920-21, pp.8-26
[9] John Marshall, 'Fresh Light on Long forgotten Civilization', *Illustrated London News*, 20 September 1924; *Annual Report of the Archaeological Survey of India*, 1923-24,1926.
[10] M.S. Vats, *Excavations at Harappa*, 2 Vol. Delhi, 1940.

excavation by Mackay between the years 1927 and 1931[12] with a view to ascertain growth of the city and excavation of the immediate surroundings leading to 'the knowledge on the conditions in which its citizens lived, their avocations and mode of life.' Such an attempt of interpretation of archaeological data could be considered forerunner of settlement archaeology in India.

Following the discoveries of Mohenjodaro and Harappa, explorations were undertaken in Sindh and Baluchistan by N.G.Majumdar, who reported mounds at Chnhodaro and Amri.[13] Stain explored northern and southern Baluchistan between 1927 and 1928, reported a number of sites of Harappan affinity.[14]

As regard to these rewarding results, Stain undertook the first planned survey work of ancient sites located along the dry bed of Ghaggar- Hakra between Hanumangarh and deltaic portion below Derawar.[15] Prior to Stains exploration archaeological reconnaissance carried out by Tod in the erstwhile princely state of Bikaner[16] and by Tessitori.[17] It is interesting to note that certain sites visited by these explorers coincide with those explored by Stain, Ghosh[18] and Dalal.[19] In the dry beds of Ghaggar-Sarasvati river Henry Field on the other hand explored the continuous region of Hakra-Ghaggar in the Cholistan desert of Bahawalpur, Pakistan.[20] Admiralty, the data surfaced during some of these field surveys could be published with limited information while some remained unpublished. For example, Ghosh explored around 100 sites but list of 47 sites could be published.[21] Nevertheless, the exploration of Ghosh brought to light more than 25 Harappan sites in the dried up river bed of Ghaggar- Sarasvati, disregarding the Stain's conclusion of absence of Prehistoric sites with Chalcolithic pottery in this area. Kalibangan appears to be the largest site in this region.[22]

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[11] John Marshall (ed.) *Mohenjodaro and the Indus Civilization*, 3 Vol., London, 1931.

[12] E.J.H. Mackay, *Further Excavations at Mohenjodaro*, 2 vols. Delhi, 1938.

[13] N.G. Majumdar, *Explorations in Sindh*, MASI, No.48, Delhi,1934.

[14] Aurel Stain, *Archaeological Tour in Waziristan and northern Baluchistan*, MASI, No.37, Calcutta, 1929.

[15] Aurel Stain, 'Survey of Ancient Sites along the 'lost' Sarasvati river', *The Geographical Journal*, 99, 1942, pp.173-82; 'An Archaeological Tour along the Ghaggar- Hakra River, 1940-42,' American Documentation Institute Microfilm No. ADI- 4861.

[16] James Tod, *op.cit.*

[17] Luigi Rio Tessitori, Exploration Bikaner, *ARASI*, 1917-18, pp.21-23, *ARASI*, 191819, pp.22-23.

[18] Amalananda Ghosh, The Rajputana Desert: its Archaeological Aspect, *Bulletin of the National Institute of Sciences in India*, 1, pp.37-42.

[19] Katy Feroze Dalal, A Short History of Archaeologocal Explorations in Bikaner and Bahawalpuralong the 'lost' Sarasvati River, *Indica*, 17(1) 1980, pp.3-40.

[20] Henry Field, An Anthropological Reconnaissance in west Pakistan, 1955, Papers of the Peabody Museum of Archaeology and Ethnography, Cambridge, 1959, 52.

[21] Amalanada Ghosh, Explorations in Bikaner, *East and West*, 4, 1953, pp.31-34; Dalal, op. cit., p.24.

[22] B.B. Lal, A New Indus Valley Provincial Capital Discovered: Excavations at Kalibangan in Northern Rajasthan', *Illustrated London News*, 1962, pp.454-57.

Beyond Saraswati-Ghaggar- Hakra plain, Rupar on Sutlaj, Alamgirpur on Hindon, were excavated during 1952-55[23] and 1958.[24] The Harappan remains were found for the first time stratifies between the deposit yielding the Painted Grey Ware and the natural soil. In the subsequent years, explorations were carried out in Rajasthan, Haryana and the Meerat and Saharanpur districts of Uttar Pradesh by various scholars including B.K. Thapar[25], Suraj Bhan,[26] J.P. Joshi[27], K. N. Dikshit[28]. These explorations were partly on a village to village survey basis and partly along the river Ghaggar, Saraswati, Drishadvati, Markanda, Sutlej and Beas. Recently, the exercise brought to light more number of sites on the palaeo-channels of Saraswati- Ghaggar- Drishadvati (Chitang)- Hakra than any other river system of the sub-continent.[29] Useful contribution was made by Pakistani archaeologist in the long stretch of Hakra river deserves special mention.

The amount of data available on the basis of past endeavors indicate that the Harappan civilization, being urban and riparian in character, with a seemingly monotones homogeneity. Its chronological span was ascribed to circa 3500 B.C. to 2000 B.C.

Previous Notices

Previous notices accounts for short interfaces which are specific to the archaeological site of Rakhigarhi. The toposheet (no.53 C/3) of Survey of India published in 1915 wherein the mounds of Rakhigarhi (29^0 16' N; 76^0 10' E) have been notably shown elevated from the surroundings. Apparently, the mounds at Rakhigarhi were first surveyed by the surveyors of Survey of India excluding antiquarian significance of the place. A prominent encircling can be noticed towards east of Rakhi Khas, and to the north of Rakhi Shahapur in the toposheet published in 1915. The Rakhi Khas is also situated on a mound as shown by contour lines indicating elevation. The elevation from the surroundings is shown as 45 ft. (14 m). The revised toposheet published in 1969 shows expansion of village

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[23] Y.D. Sharma, 'Past Patterns in Living as unfolded by Excavations at Rupar' *Lalit Kala*, 1-2, pp. 121-29.
[24] *Indian Archaeology-A Review* p.
[25] B.K. Thapar, The Mosaic of the Indus Civilization beyond the Indus valley, *Indus Civilization: new Perspective,* A.H.Dani (ed.), Islamabad, 1981, pp.55-64.
[26] Suraj Bhan, *Prehistoric Archaeology of the Saraswati and Drishadvati Valleys*, 1972, Ph.D. Dissertation, Department of Archaeology, M.S. University, Baroda; Mitathal (1968) and other explorations in the Sutlaj-Yamuna Divide, Kurukshetra, 1975.
[27] J.P.Joshi, Excavations at Bhagwanpura 1975-76 and other Explorations and Excavations 1975-81 in Haryana, Jammu & Kashmir and Punjab, MASI 89, pp.227-56.
[28] K.N.Dikshit, Explorations along the right bank of river Sutlej in Punjab, Journal of Indian History, 45 (2), pp.561-68; Hulas and the Late Harappan Complex in Western Uttar Pradesh, G.L. Possehl (ed.) *Harappan Civilization: A Contemporary Perspective*, Delhi 1982, 339-51.
[29] We are having data of Harappan sites explored largely in Gujarat and a couple in Maharashtra as the inferences fall outside the preview of the present study.

toward south and southwest encroaching on the elevations. Three mounds noticed in the north of the village remain unoccupied till now.

The first exploratory data was published by Suraj Bhan in 1969[30] wherein he recorded the mature Harappan traditions in town planning, architecture and in arts and crafts at Rakhigarhi. The household equipments such as cubical stone weights, saddle querns, bone pins, chert blade, terracotta wheeled bird, animal figurines, toy carts and bangles, beads of semi-precious stones, steatite, faience and clay were showing typical Mature Harappan features. The characteristic pottery types including painted motifs were also collected from the site.[31] In his subsequent writings Suraj Bhan notices 'twin or dichotomous configurations' at the site, 'a huge mud brick platform' on the western mound and collected pottery typifying pre Harappa, Harappa and late Harappa. However Silak Ram picked up pre- Harappan and Harappan pottery types.[32] An early-Harappan site, locally known as Arada was reported to a half kilometer west of Rakhigarhi. The three meter thick cultural deposit was spread over an area of 300 square meter yielding bricks with 1:2:3 ratio and fabrics A,B,C and D of the Kalibangan ceramics.[33] Apart from this there are three published references on the finding seals. The one kept in the Jhajjar Museum,[34] and earlier published by Parpola[35] Joshi and Parpola further published a couple of seals in their joint publication.[36] Lastly, two seals from Rakhigarhi were published by Phadke.[37]

Folklore

As per the tradition, the region was under the hegemony of Arjuna. He killed Jamadagni, a sage in fight. Parshuram took the revenge by killing Arjun and his associates with his battleaxe; Parshuram who is said to have spilt the blood of the Kshatryas in this place. Later he cleaned the battleaxe at *Rama-hrad* (sar) lake, this site has been identified with the pilgrimage centre at Ramray (after Saraswati Omanand). *Ram-hrad* lake was called by various names as Brahma-Sar, Vayu or Vayava-sar and Pavana-Sar. Ramray is on Jind-Hansi road and lies 15 km to the

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[30] Suraj Bhan, Excavations at Mitathal, *Journal of Haryana Studies* Vol. I, No.1, 1969, p.12
[31] Suraj Bhan, *Excavations at Mitathal and other Explorations in the Sutluj-Yamuna Divide*, Kurukshetra, 1975, p.124
[32] Silak Ram, *Archaeology of Rohatak and Hissar Districts* (*Haryana*) Kurukshetra 1972, pp.77-78.
[33] *IAR*- 1987-88:27
[34] Swami Dayanand Sarswati, Ancient Seals of India, Jhajjar, 1975, pp. 81-82, Pl.51.
[35] Asko Parpola, *Acte Orientalia*, Vol.35, 1973, pp.103-114.
[36] J.P. Joshi and Asko Parpola, Corpus of Indus Seals and Inscriptions, Vol. I, Collections in India, Helasinki, 1987, pp. .., Pl….
[37] H.A. Phadke, Harayana: Ancient and Medieval, New Delhi, 1990, p.3, pl.3 & 4.

east of Rakhigarhi. As per the tradition Rama-hrad lake was part of the land of Kuru. It is said that Kuru became an ascetic on the bank of the great lake situated to the south of Kurukshetra.

Traditions and Toponym

Haryana, as we know, has been carved out the southern part of the erstwhile Punjab state in 1967. Ever since its bifurcation, attempts have been made to research the antiquity of derivation of its name: Haryana, denoting political boundary. The earliest inference in Rigveda refers to *Harayane* in the context of state (*RV* 8.25.22).

Rijamrksanyane rajatin harayane /
Rathin yuktamasanama susamani//

Acharya Yaska has defined Harayanah as *Haramanayanha*, denoting region where chariots are in use. The word *Uksanyayana* used in the above noted hymn denotes suitable (region) for oxen pen. It may be noted that oxen driven chariots/ carts are still in vogue in this part of the country. The oxen of Hissar district are still continued to be the best in the region and most sort after livestock. The *kumaraka khanda* of *Skandha Purana* refers to '*Hariyala' janapada* denoting the region of Haryana.[38] Both these nomenclatures supplement the meaning of *Harayane*. Apart from the traditional resources there are few epigraphical data deserve reference.Hareyanaka, as the name of a village, occur in the inscription of Dhruvasena I assigned to A.D. 526-27 (Hastava praharnyam Hariyankagrame...)[39] Among the medieval epigraphs, the Palam Baoli(stepped well) inscription (v.s.1237) records Hariyanaka[40] (Haryana) while the inscription housed in Delhi Museum (v.s.1384) refers to Hariyana[41] (Haryana). Another inscription in the repository of Udaipur Museum (v.s. 1487/A.D.1430) refers to construction of a well by Vidyadhar, a descendant of Surapala of the Gauda family of Hariyana[42] (Haryana). Another inscription of Qutub-ud-din's time in Ajmer Museum, records *Dhilli* (Delhi) as big town of *Haritana desha*.[43] Sant Garibdas, a Saint of 19th century includes the region of Haryana Braja and Ghaggar, and Bagda and the Yamuna, comprising

[38] Studies in the Geography of Ancient and Medieval India, p.260.
[39] Buddha Prakash, Inscriptions of Dhruvasena I, Haryana: Studies in History and Culture, Kurukshetra, 1968, p.42.
[40] *E.I.*
[41] *E.I.*
[42] *E.I.* ASI, 1930-34, Part I, p.227.
[43] *E.I.* 1982 Pandit Ram Karna, 'Ladnu Inscription of Sadharna 1373' Vo. XII, pp.18-23

area between Delhi, Hissar and Narwana-Tusham.[44] It appears from the above that the use of nomenclature from this region is derived from green pasture and wealthy yields/produce. Hence we come across such terms in Veda, Purana literature and epigraphs.

The core districts of Harayana consisting of Rohtak, Hissar and Kurukshetra and its contiguous region of Matsya, Panchala and Surasenaks comprise the holey enclave of the *Bramharshi- desha.*[45] Another cognate inference from *Manu-Samhita* specifies the land of *Bramhavartta* between the divide of Sarsvati-Drishadvati rivers covering the modern districts of Kurukshetra, Hissar and Rohatak.

Sarasvati drishadvatyodeva nudor yadautaram

Tandeva nimitam-desar Bramhavarttan prachalechate

'That region, made by the gods, which is between the Sarasvati and Drishadvati rivers is called *Bramhavartta.*'[46] These rivers also find reference in *Mahabharata* in the context of Kurukshetra.

Dakshinena Sarasvatyah Drishadvatyuttarena-cha

Ye vasanti Kurukshetre vasanti trivishtape

"South from Sarswati and north from Drishadvati, they who dwell in Kurukshetra live in paradise."[47]

The river Sarasvati finds reference in *Rig Veda* (*RV.* 3.24.4) along with its tributaries- Drishadvati and Apaya:

Drishadvatyam manusa Apayayan Sarasvatyam revadange didihi

It is stated to have originated in the mountains and discharged in the sea:

ekachetat Sarasvati nadinam suchir yati giribhya a samudrat /

The Rig Veda further refers to King Chitra who lived on the bank of the Sarasvati (*RV.* 8.21.18). In another inference it refers that the river was associated with King Nahusha (*RV* 7.92.2). Besides there is an inference (*RV* 6.61) that she gave Divodasa, the famous Vedic king, to Vadhrayasva. Similarly there is reference that 'five specific peoples' lived in the Sarasvati valley, of whom one has been clearly stated to have been the Purus (*RV.* 7.96.2).[48] The river Sarasvati has been further addressed as (*RV.* 2.41.16) *ambitame* (the best of mothers), *devitame* (the

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[44] '*Dilli mandala desa bakhano Hariyana kahalavai*
Bagada Jamuna madhe ichalai sukhadai mana bhavai
Braja aura Ghaghari madhya Hariyana. Samajha vichro bhai
Hariyana aanand mana bhaya Jahaun dudha dahi sukhadai' after Acharya Bhagvandeva, *Virbhumi Haryana*,1965, Jhajjar, p.201.

[45] *Manu-Samhita*, IIp.19, Hemchandra Raychudhari, *Political History of India*, 1923, Calcutta, 1872,p.215

[46] Alexander Cunningham, *ASIR*, 1863-63, Vo.II, Calcutta, 1872, p.215.

[47] Alexander Cunningham, *ASIR*, 1863-63, Vo.II, Calcutta, 1872 p.24.

[48] B.B. Lal, *The Saraswati Flows On: The Continuity of Indian Culture*, New Delhi, 2002, p.9.

best of goddesses) and *naditame* (the best of rivers). She was capable of devastating the high ridges of the mountains on its banks through the force of its fast moving and powerful currents (*iyam susmebhir bisakha ivarujat sanu girinam tavisebhirurmibhih).*[49] It also refers (*RV.* 10.75.5) that she was flowing between the Yamuna and Sutluj (*imam me Gange Yamune Sarasvati Sutudri*).[50]

Presently the river Sarasvati originates in the Siwaliks and passes through Khairi, Pipli, Kurukshetra and Pehowa. Thereafter joins the Ghaggar flows further down but dried up near Sirsa. Their palaeo- channels have been identified beyond Sirsa, in upper Rajasthan this channel is known as Ghaggar and further down in the Cholistan desert of Pakistan it is called as Hakra. Its southward flowing streams in Sindh are known as Raini and Wahind. Its continuation is marked by Nara through which it flowed into Rann of Kachchh (Kutch).[51] An intensive survey carried out in the Saraswati basin within Haryana has brought to light important Harappan sites at Banawali,[52] Kunal,[53]etc. However the excavations at Bahgwanpura and Kashithal in Kurukshetra district have thrown an important light on the stratigraphic relationship between the late Harappan and Painted Grey Ware cultures by yielding evidence of a partial overlap between the two. The number of Harappan sites reported from reported from this basin is less than its tributary Drishadvati.

The Drishadvati, one of the tributaries of Sarasvati (RV 3.23.4), has been identified with the modern Chitang or Chutang. It originates in the hilly regions of Ambala and traditionally its upper course was known as *Patharalanadi*. The Drishadvati ('rocky' or 'stony') run to south-east of the Sarasvati and passes through Kapal Mochan, Balchapper and Mustafabad. Its channel can be further traced westwards along Ladwa, south of Kurukshetra, Punjam, Nisang Asandh, Jind, Rakhigarhi, Hansi, Hissar, Siswal and Mitathal in Haryana. In Rajasthan it can be traced along Bhadra, Sothi, Nohar, Rawatsar etc. till it joins the Ghaggar (Sarasvati) about 5 north of Suratgarh. Apart from Rakhigarhi, sites located in the plains of Drishadvati are Sothi, Siswal, Mitathal, Balu, Daulatpur etc. It may be stated that in the upper reaches of this rivers there is a concentration of late Harappan and Painted Grey Ware sites often suggesting eastward in the Ganga-Yamuna valley.

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49 *Ibid. p.10*
50 *Ibid. p.11*.
51 Suraj Bhan 'Sarasvati valley', An Encyclopedia of Indian Archaeology (ed.) A.Ghosh, Vol. II, p.395.
52 R.S. Bisht, 'Excavations at Banawali:1974-77', Harappan Civilization a Contemporary Perspective, G.L. Possehl (ed.), Delhi, 1982, pp113-24.
53 J.S. Khatri and M.S. Aacharya, 'Kunal: A New Indus-Saraswati Site, Puratattva, 25, 1995, pp. 84-86.

The Drishadvati, which occurs many times in the *Rig Veda* along with the Sarasvati as an important tributary is identified with modern Chitrang or Chutang or Chitang,[54]Rakshi,[55] and the western Yamuna Canal with its Hansi- Hissar branch.[56] Among other names associated with Drishadvati, occur in the traditional sources are Ratnavati,[57] and Raupaya.[58] Traditionally, the river formed the southern boundary of the Kurukshetra.[59]

Between the Sarasvati and Drishadvati flowing past Kurukshetra in the Apaya (RV, 3.23.4), a small tributary of Sarasvati:

Drishadvatyam manusa Apayayam Sarasvatyam Revadange didihi

The Vamanpuran (ch.36) records it Apaga. The Apaga or Aughvati is a branch of the Chitang which separates from the main stream a few kilometers to the west of Ladwa, and flows past Pulwal to Pabnawa, where it is lost in the sands. Its whole length is 37 km.[60] The river flows below Kaithal, where it has been traced along Guhana, Ujhana, Dhantam, Prithala, Lahariyan, Sotar Palsar, Fatehabad, Jodhkan, Shahapur Begu, Chuburja, Modia and beyond it formed into a water body called the Trinabindu lake. The spill over of the lake water flowed further part of Mallehka, Kothi etc. and joined the Ghaggar- Sarasvati at Maujakheda.[61] It is belived, the river got branched-off at Karnauli, 8 km west of Fatehabad- a well known Harappan site.

Another river running parallel to the Sarasvati was Sarayu. Its palaeo-channels in Hissar district part through Jakhal, Ratia, Kalotha, Huinga, Shardulgarh, Panihari and Khaireka. It joined the Sarasvati little above towards Ottu.[62]

The Kaushiki is another holy river, finds reference in the Mahabharata as an affluent river of the Drishadvati, and their confluence, noted as one of the holy places has been identified *Kaushiki Sangam* near Balu on the rakshi (Drishadvati)

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[54] B.C. Law, *Geographical Essays*, London, Vol. I, 1937, p.91.
[55] A. Cunningham, *ASIR*, XIV, p.88.
[56] M.L. Bhargava, *The Geography of Rigvedic India*, Lucknow, 1964, p.56.
[57] *Vayupurana*, LIX, pp.12-28.
[58] *Mahabharata, Vanaparva*, CXXIX
[59] A. Cunningham, ASIR, II, p.216.
[60] A. Cunningham, *ASIR*, 1878-79, Vol.XIV, p.89.
[61] M.L. Bhargava *op.cit.*, p. 63.
[62] M.L.Bhargava, *Ibid*, p.27.

rivers, located 28 km south of Kurukshetra.[63] On the confluence at Balu, early, mature and late Harappa assemblage has been reported.[64]

Visibly, the above description from the ancient Indian scriptures signifies the holy character of the Sarasvati and its tributaries which served as indicator in shaping contemporary mind set of the Rigvedic Aryans. The inspiration of pious thought explaining matter and objective things as proudest of the subjective mind has been understood in explode recite: *Chodayitre Surcitanam chetanti Sumantinam* (*RV*. 1.311). The environment generates and illuminates all intelligence: *vajebhiravajinevate* (*RV*.1.3.10).

The Sarasvati without any mention of river aspect is invoked as *Apri* along with other deities, to be present at sacrifices (*yajnas*): ***Ila Sarasvati Mahi tisro devirmayobhuvah/ Barhih Sidantvastridhah//* (*RV*. 1.13.9):** May the three goddesses, the Ila, Sarsvati and Mahi who bring delight and never fail, be seated on sacrificial grass and: ***Suchirdevesvarpita hotra Marutsu Bharati/ Ila Sarasvati Mahi barhih Sidantu yajniyah//* (RV1.142.9):** 'Pure and revered amidst the gods and the Maruts, may Bharati, Ila, Sarasvati and Mahi be seated on the sacrificial grass'. In another attribution, Sarasvati has been associated with *dhi* (intellect) while playing the role of an *Apri* goddess (RV. 2.3.8). Elsewhere she is said to 'regain over thoughts': ***maho arnah Sarasvati pra chetayati ketuna/ dhiyo vishwa vi rajati//* (RV. 1.3.12):** Sarasvati illuminates all intellects.[65] There is an invocation to Agni: ***ni tva dadhe vara a prithvivya ilayaspade sidinatve ahanam/ Drisadvatyam manusa Apayam Sarasvatyam revadagne didihi //* (*RV*. 3.23.4:** 'O Agni I have established you at the best place on the earth, in the dwelling of Ila, this most auspicious of the days; may you shine brilliantly amongst the descendants of Manu on the banks of the Drishadvati, Apaya and Saasvati.[66] Performance of the great sacrifice of *Satranta* on the banks of Drishadvati finds reference in Vayupurana.[67] Mahabharata infers disappearance of Sarasvati in the sandy desert.[68] Along the dry courses of mighty river Sarasvati and its tributaries a number of archaeological sites have been reported showing data on performance sacrifices, where hopefully these rhymes were chanted. The ancient sites dotted in

[63] A. Cunningham ASIR, 1878-79, Vol.XIV, p.88, in the following pages Cunningham records the Kaushiki as branch of Rakshi, *Ibid*., p.89.

[64] Suraj Bhan and J.G. Shaffer, New Discoveries in Northern Haryana, *Man and Environment*, Vol.2, p.62. Incidentally, the site has been shown on the right bank of Apaya, see Kesarwani A., 'Balu: A fortified rural settlement in Haryana' *Puratattva*, No.312001, p.145.

[65] B.B.Lal, Op.cit., 2002, pp.5-6.

[66] *Ibid*. p.3.

[67] A. Cunningham, *op cit*., p87.

[68] Mahabharata, 111.80.118: *Gachchatyartita yatra-maruprsthe Sarasavati*.

the flood plains range from early Harappan, Harappan, late Harappan, Painted grey Ware to Ragmahal times. Other than Rakhigarhi important sites located in the Sarasvati-Drishadvati divide are Kalibangan, Banawali, Kunal, Bhirrana, Mitathal, Siswal, Balu, Bhagvanpura, Raja Karan-ka-kila and Ranghmahal.

Antecedents of Subsistence

Evidence reminiscent to the emergence of the subsistence pattern during the Harappan times needs to be explained by analyzing the cultural traits of the preceding period. Here the examples of development in the changing environmental context reported from upper Paleolithic, Neolithic and Mesolithic sites located in the peripheral regions of Indo-Gangetic plains have been examined with a view to highlight the process of the transformation which influenced the subsistence pattern of the core area of the Sarasvati-Drishadvati divide. The peripheral regions constitute – (i) the central Gangetic plains and the Vindhyas in the east, (ii) the Kachi Plain on the borders of Sindh and Baluchistan in the west, (iii) the piedmonts of the Himalayas in the north and (iv) the piedmonts of the Arawallis and its drainage in the South.

(i) The Central Gangetic plain and piedmonts of the Vindhyas.

Before discussing the well documented data from the central Gangetic plains it would be contextual to know the evidence of middle Paleolithic artifacts and Upper Pleistocene climate reported at Kalpi in the lower Yamuna plains, lithic and bone artifacts have been dated by infrared Stimulated Luminescence (IRSL) technique to around 45 kyr. Geochemical and mineralogical studies of sediment samples suggest humid climate. The lithic assemblage here in limited area, consists of pebble tools cores, untouched pebbles, and atypical points, side-scrappers, chips etc. while the bone artifacts distributed relatively in a larger area include end scrapper, point notched tool, burin, atypical end scrapper, and bones with cut marks; besides a large mammal vertebra and animal skull showing cut-marks. Seemingly, used as anvil, a triangular point with fired hardened tip, a 3.54 m long elephant tusk and 1 m long elephant shoulder blade are other significant finds. Along with these artifacts the evidence for human occupation has also been reported in one of the investigative stratigraphic unit viz. Event II assignable to late Pleistocene.[69] It may not be out of place to note that earlier sporadic occurrence of

[69] Rakesh Tiwari *et al* .Middle Paleolithic Human activityand Paleoclimate at Kalpi, Yamuna Valley, Ganga Plain, *Man and Environment*, Vol.27, No.2, pp.157-58.

Lower and Middle Paleolithic tools from the Yamuna section at Mau,[70] Bahadarabad,[71] Anagpur,[72] Delhi[73] have found some relevance in the light of evidence obtained at Kalpi. The discovery of a series of Middle Paleolithic and Mesolithic sites in the Gangetic plains belies the age old mind set that the Ganga-Plain was unsuitable for the Stone Age human habitation.

Encouraging results from hunting-gathering nomadic Upper Paleolithic stage to a food producing and settled one during the Neolithic times have been obtained at sites namely Chopani Mando, Koldihwa and Mahagara located in the south of the Central Ganga plains.[74] A definite chronology to the Upper Paleolithic blade-burin horizon dated to 1915 -+ 340 B.P.[75] could be obtained for the first time. The cultural components are marked by rapid technological advancement, together with imaginative expression of artistic talent. Three occupational levels identified from bottom upwards, as Epi-Paleolithic denotes transitional phase of the Upper Paleolithic and advanced Mesolithic/ Proto-Neolithic. The Epi-Paleolithic denotes transitional phase of the upper Paleolithic showing diminishing assemblage of the blade-tools. The Early Mesolithic horizon is further classified into two- on the basis of frequency occurrence of non-geometric and geometric microliths. So far 172 sites have been assigned to non-geometric Mesolithic phase. The finished tools have been fashioned out of chert, chalcedony, agate and carnelian. Though the sites are free from human remains, increase in the density of population may be postulated on the basis of the number of sites reported. Besides, the siliceous materials on which these tools have been crafted suggest beginning of long distance exchange network. The geometric Mesolithic phase has been reported at 21 sites, yielding unfinished waste and finished artifacts together with rich cultural material and biological remains which indicate semi-sedentary settlements. The excavated sites like Sarai-Nahar-Rai and Mahadaha and Damdama have yielded date logical research enabling in the reconstruction of the culture of the early Holocene period in the Ganga plain. Wide range of tool types, namely retouched blades, varieties of scrappers, points, bores, awls, triangles, trapezes, indicate their function as hafted tool in hunting with the bow and arrow, besides sickles for clearing wild grass

[70] *IAR*1968-69, p.34
[71] A.K.Sharma, Bahadarabad, *Encyclopedia of Indian Archaeology* (A.Ghosh Ed.)1985, New Delhi, p.37.
[72] A.K.Sharma and S.B.Ota, Anangpur, *Puratattva* 21, 1990-91, pp.73-74; Chakrabarti and N. Lahiri, A Preliminary Report on Stone Age of the Union Territory of Delhi and Haryana
[73] B.M. Pane, A late Ascheulian hand axe from New Delhi, *Man and Environment*, IX 1985, pp157-58.
[74] G.R. Sharma, V. D. Misra D. Mandal, B.B. Misra and J.N. Pal, *Beginning of Agriculture*, 1989, Allahabad.
[75] G.R. Sharma. Stone Age in the Vindhyas and ganga Valley', *Radiocarbon and Indian Archaeology*, (eds. D.P.Agrawal and A. Ghosh), 1973, Bombay, pp.106-110.

patches, cutting up wild grains, fruits and harpoons for fishing. Two bone arrowheads together with concave bone object with burnished surface bearing a couple of perforations might indicate its possible use as a quiver. The ambiance of these sites around ox-bow lakes, brooks and streams provided opportunity to birds, aquatic animals like fish and turtles, whose remains have been obtained from cuttings. Other than working on the bone implements, the Mesolithic people of the central Gangetic plains also ventured in the preparation of ornaments on bone and antler. Finished and unfinished ear rings and necklace together with antlers having deep grooves and burnished surface indicate the artistic endeavor and capacity of adapting to new technology. Apart from this, discovery of numerous nodules of hematite and ochre with rubbed surfaces indicate their use in painting the skin-hide or prepared surface as was used for executing rock paintings of the Upper Paleolithic and Mesolithic times in hilly region.

Two types of hand made pottery make their presence in the advanced Mesolithic/ Proto- Neolithic stage. Typologically brownish-grey ware, the thin red ware which was better fired than the former. Both the types however, bear impressed designs on the exterior. Besides microlithic tools, other objects included querns and mullers, anvils, hammers, ring-stones etc. suggest their specialized function as house hold items in tilling, pounding and grinding. Evidence of mud-floors and huts of wattle and doub indicated by the discovery of reed and bamboo impressed lumps of clay provide another cogent inference to this beginning of settled life pattern. However, the evidence of domesticated animals and plants has come to light from the Neolithic period reported at Koldihawa and Mahagara. It may not be out of place to record that the husk used in the Neolithic pottery of Loldihawa has been identified as domesticated variety of rice; thereby this may be treated as the earliest evidence of cultivation of rice in India dating back to seventh- sixth millennium B.C.

The evidence of disposal of dead from the habitation area further strengthens the emergence of settled life in the central Gangetic plains during the Mesolithic period. Leaving a few exceptions in the disposal of body in the grave like lying in the crouching position[76] flexed position with folded legs and a double burial of male and female, the skeletons largely were laid supine in an extended position, oriented east-west, with head towards west. Double burials of males and females

[76] J.N. Pal, Mesolithic double burials from recent excavations at Damdama, Man and environment, XII, pp.115-122.

perhaps indicate the concept of family, it is noteworthy phenomenon.[77] The grave goods reported from the burials include items of antler, bone marrow-heads, necklace and ear rings of boneetc. A few of these graves containing ornaments and bone arrowheads may be indicative of special status of the buried individual in the contemporary community of the Mesolithic times.[78] In Mesolithic context, the bone objects as grave goods have been reported from Langhnaj,[79] Bhimbetka[80] and Lekhania,[81] suggestive of formulation common rituals, hypothecating life after death.[82]

(ii) The Piedmonts of the Aravallis and its Drainage

Comparable ecological data with that of the Central Gangetic plains is available for the hunting-gathering communities of Rajasthan who progressed from semi-nomadic pastoralists to incipient slash-and burn agriculturist, combined with imaginative power and artistic talent.[83] The data obtained from Salt lakes such as Sambhar and Didwana[84] and the river systems of the Aravallis have been relied upon to understand the mechanism leading to emergence of urban subsistence pattern in the Sarasvati-Drishadvati divide. Palynological studies carried out in the Sambhar, Didwana, Lunkaranesar and Pushkar lakes have brought to light climatic sequence from end Pleistocene to Holocene times. Phase-III dateable to circa 7500 to circa 3000 B.C. has reported *cerelia*-type pollen and carbonized vegetable remains from the sediments of these lakes. These two findings indicate scrub burning by man for slash-and burn agriculture. While phase IV, assignable to circa 3000 to 1000 B.C. witnessed considerable increase in the rainfall and emergence of early and Mature Harappa Civilization in north Rajasthan.[85]

Visibly, archaeological evidence based on hunting-gathering and agro-pastoralism has been evidenced at Tilwara, Bagor and Ganeshwar Jodhpura.

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[77]B.B.Lal, The earliest Civilization of South Asia, New Delhi, 1997, p.22.
[78] J.N. Pandey, Settlment Patterns and life in the Mesolithic period in Uttar Pradesh, D.Phil, Dissartation, Allahabad, 1985, pp.281-282; Mesolithic burials in India, Mesolithic India, Ed. V.D. Misra and J.N. Pal, Allahabad, 2002, pp.356-365.
[79]
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[82] R. K. Verma, The Mesolithic Cultures of India, *Puratattva*, 1981-83,13-14, pp.34-5.
[83] V.N. Misra, *et al*. Prehistory…… *Man and Environment*
[84] V.N.Misra, Acheulian Occupation and evolving landscape around Didwana in the Thar Desert India, *Man and Environment,*
[85] Gurdeep Singh, The Indus Valley Culture seen in context of post-glacial climate and ecological studies in northwest India, *Archaeology and Physical Anthropology in Oceania*, 6(2), 1971,pp177-189; Gurdeep Singh *et al* Late Quaternary history of vegetation and Climate of Rajasthan Desert, India, *Philosophical Transactions of the Royal Society of London*, Vol.267, 1974, pp.-467-501.

Tilwada (25^0 52'N; 72^0 50'E) situated on the left bank of Luni, has reported two phases of occupation, the lower one regarded as Mesolithic. This phase is characterized by microliths, the main types consisting of backed blades, obliquely blunted blades, lunate triangles, points and few trapezes displaying a remarkable perfection in form and workmanship. The materials used were quartz, quartzite, chert and rhyolite. Quartz was available in the river bed, whereas other materials in the Malini formations located near Tilwada. Distinct floors at varying distances, some making the outline of the circular hut were noticed. Over the floor were noticed a flat-topped quern kept in an inclined position with a muller over it. Two circular ashy patches marked the spot where fire had been heat over a prolonged period. Both the quern, muller and ashy patches suggests exploitation of wild cuttings of the cultivable grass to meet the food requirements of that stage of life. The wheel turned grey and red pottery types were found in abundance in the upper levels while the percentage of occurrence decreased in the lower levels. Of varying sizes, wide mouthed grey-ware *handies* with increased decoration over the rims had a thin dull grey slip and a darkish core. Some of the *handies* had bottoms with soot marks indicting their use as cooking ware. The red ware, with a pale red slip and reddish core was represented by the *lota*-like vessel and shallow dish. The faunal remains belonged to the domesticated cattle, sheep/goat and moluscan shells.

Among other finds were reported shell bangles from upper deposit, while beads of bones and carnelian within 30 cm below surface.[86] The evidence of circular floors together with quern and muller, two circular clay patches suggest subsistence pattern of type wherein domestication and food processing elements were introduced, seemingly a significant shift in the hunting gathering tactics. Knowledge of shell bangle, beads of carnelian and bone in the upper level of the settlement suggests interaction with sites of upper Rajasthan located in Sarasvati-Drishadvati plains. The sites need to be re-excavated with a view to determine the aceramic and ceramic horizons of the Mesolithic period and accordingly study the subsistence pattern to observe the process of development.

Relatively, the evidence obtained at Bagor (25^0 21'; 74^0 23') provide a wider perspective to the understanding of the Mesolithic culture of Rajasthan in the context of central Gangetic plains, Vindhyan piedmonts, central Narmada valley

[86] *IAR*-1967-68,pp.39-41 A.Ghosh (Ed.), Tilwara, An Encyclopedia of Indian Archaeology,1984, New Delhi; V.N. Misra, Two Late Mesolithic Settlements in Rajasthan-A Brief Review of Investigations, *Poona University Journal* (Humanities Section), 35,1971,pp.59-77; V.N.Misra Bagor: the Archaeological settings in Bagor and Tilwara: Late Mesolithic Cultures of Northwest India, Vol. 1, The *Human Skeletal Remains* (J.R. Lukas *et al* Ed.), Poona, 1982, pp.9-26.

and upper Gujarat. Situated on the left bank of Kothari River, a tributary of Banas lies in the centre of the Mewar plains in the shadow of the Aravallis. The site is located in the settings of arable and pastureland providing an ideal location for community practicing incipient agriculture and pastoral subsistence.

Earlier excavation reported two periods of occupation at the site.[87] Period I (phase I) assigned to late Mesolithic times, was characterized by microlithic and animal bones together with subsistence based on a combination of hunting-gathering and herding.[88]

Recent excavations at the site, however, have transformed the knowledge from late Mesolithic occupations to regular Mesolithic horizon, subdivided into two phases namely –Phase A: Aceramic Mesolithic and Phase B: Ceramic Mesolithic.[89] Aceramic phase brought to light a couple of dwelling structures marked by compact surface with a post-hole, one of them possibly had circular plan. Over the floors were strewed large amount of debitage with some hooks and charred fragments of animal bones. Besides the evidence of large core of quartz with debitage, a couple of heavily used rubber stone made of fine grain sandstone may serve as associated equipment used for sharpening and polishing. Both these structures appear to be makeshift type, supported by a serene of wattle and daub wall along the stone lining. Quartz was preferred over chert for preparing tools. This phase has been dated to 5680 B.C. by AMS dating method.

Phase B is marked by the introduction of ceramic industry, while other cultural traits continued to coexist without any drastic change. The pottery, coarse in fabric, mixed with grass and sand, ill fired is basically made on a slow turn-table. Many sherds bear incised design which include groups of parallel bands, chevrons, herring box pattern, criss-cross, groups of short stokes and finger nail. Apparently, the pottery was obtained from agriculture base rural settlements in the area rather than produced at the site. The pottery is reminiscent to those reported from the Mesolithic horizon at Belen valley deserves competitive study. Patches of well rammed floor have been noticed. One is spotted with fragments of quartz cores together with debitage and finished tools dispersed over the floor area. Another floor showed concentration of animal bones, saddle quern together with grinding stones and pottery. The evidence of microliths, animal bones suggests the economy

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[87] *IAR* 1967-68,pp.41-42; V.N. Misra, Bagor, *An Encyclopedia of Indian Archaeology* (A.Ghosh ed.), New Delhi, 1984, pp.34-37.

[88] V.N. Misra, Bagor-a Late Mesolithic settlement in Northwest India, World Archaeology, 5(1), pp.92-110.

[89] Vasant Shinde, Shweta Sinha Deshapande and Yoshinori Yasuda, Human Response to Holocene climate change-A case study of Western India between

based on combination of hunting-gathering and herding. The animal bones included cattle, sheep, goat, deer and other wild species. The make shift type of hut with stone paved floors were in certain cases, sheltered behind wind breaks.

Earlier excavations have reported five burials which may be associated to the Aceramic phase of the recent excavations. Here, the dead were disposed in an extended position with the lower left arm resting partly over the trunk and head towards the west.[90] In contrast to the Mesolithic burials of the Central Gangetic Plains and Vindhyas, no grave goods are associated with the burials at Bagor.[91]

Like Bagor, further excavations carried out at Ganeshwar (37⁰ 40' 00"; 75⁰ 51' 30"), district Sikar[92] have enriched our knowledge for the present survey of Mesolithic sites closer to the Sarasvati-Drishadvati divide. The excavations of 1087-88 have brought to light regular deposit of a true Mesolithic hunting-gathering settlement.[93] Earlier excavation at the site, however, could not distinguish a separate horizon of the microlithic assemblage which was consisted of micro as well as large blade scrapers made on flakes, burins and blunted back blades, points, lunates, triangles and trapezes, etc. besides faunal remains of domesticated and wild varieties. The site is very important as it may provide an insight into the convincing local antecedents leading to independent evolution of civilization in the Sarasvati-Drishadvati valley. The site deserves to be re-excavated with a view to reassessing the process whereby the Mesolithic hunter-gatherers adopted their way of progressive life to copper using stage.

The preliminary report published on Ganeshwar[94] provides three occupational phases. From the available report, Phase I may be attributed to the Aceramic Mesolithic horizons as suspected at Tilwara.[95] and reported at Bagor[96]. The site has reported microliths and animal bones as the main cultural components of the Aceramic phase. Like Bagor and Tilwara, quartz was preferred over other materials, but the finished tools at Ganeshwar are made on chert. Essentially, geometric in character, the main tool type are blunted back blades, pen-knife blades, triangles, points, crescents, trapezes, and transverse arrow-heads while scrapes and burins made on flakes are relatively merger in occurrence. The excavator rightly reports that the tools were manufactured within the settlement,

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[90] V. N. Misra, Bagor, An Encyclopedia of Indian Archaeology, (A.Ghosh ed.) New Delhi, 1984, pp34-37.
[91] Example of burials without grave goods have been reported at Langhnaj, Dhrmeswar, Panchmarhi.
[92] For previous excavation results refer *IAR* 1983-84, pp.71-2.
[93]*IAR* -1987-88, pp.101-102.
[94]*IAR*-1987-88, pp.101-102
[95] *IAR*-1967-68, pp. 39-41
[96] Vasant Shinde, Shweta Sinha- Deshpande and Yashinore Yasuda, *Op. cit.*, pp. 393-398.

but report is silent about the nature of dwellings. The animal bones reported from the lowermost level indicate exploitation of small games and birds at the beginning of the settlement, while the larger bones are often charred and invariably broken/ split for the exploitation of marrow. Recovery of bones of wild animals is larger than the domesticated ones which remain to be studied. Phase II is characterized by the introduction of ceramics and copper technology. Pottery christened as Ganeshwar-Jodhpura Ware, a mix of handmade and slow wheel made. Largely the fabric is course and micaceous, ill fired-leaving dark and smoky core. The surface originally was treated with red slip but had faded to dull brown. Examples of well levigated and well fired pottery with an ocharish core are fairly sturdy but limited in number. The pottery type include narrow and wide mouthed jars, medium sized square *handis, lota* like carrinated vassals of varying sizes, shallow pans, bowls of various sizes and deep basins. Similar to Bagor, the incised decoration over some of these pots included set of straight or wavy lines, chevrons; herring bone pattern and criss-cross. Functionally, the pottery types served the household purpose of storing, cooking, eating and drinking. The copper implements included arrow-head, fish-hook, sphere-head and awl.

Out lines of the paved floors consisting of river pebbles and schist and circular huts were also traced. Phase III yielded plenty of copper implements, say over 90% of the total material which served as main commodity of the exchange network, largely with the contemporary urban centers located in the plains of Sarasvati rivers. Apparently at this stage the copper mines of the neighborhood were exploited largely to balance the demand and supply of these artifacts. These included arrowheads, rings, bangles, sphere-heads, chisels, balls, celts etc. Similarly the pottery types like goblets, beakers, tumblers, cylindrical vases, lids, jars, offering stands, dishes, basins reported at the site are reminiscent to those start occurring in the early Harappan context. The tentative dates given to these phases by the excavator needs to be reconsidered in the light of AMS dates available for Bagor. Relatively, Aceramic phase I at Ganeshwar may turn out to be contemporary with the Aceramic phase at Bagor dating back to 6th millennium B.C., ceramic phase II fifth –fourth millennium B.C. and phase III to third millennium B.C.

The kind of evidence occupying from Bagor and Ganeshwar deserves parallel research prospect with a view to understand an uninterrupted culture sequence concentrating on the sites in Aravallis and the Sarasvati- Drishadvati and observe role of integration played by them from hunting-gathering stage to the emergence of

agro-pastoral way of life, leading to evolution of the civilization in Haryana and upper Rajasthan. The above results may reveal the relationship between the tableland and river plains in the areas of domestication of plants and animals and exploitation of mineral resources.

Kachchi Plains

In contrast to Mesolithic stage of cultural development in Rajasthan, the Quetta valley sites in the west of study area has provided a Neolithic horizon wherein hunting and gathering stage transformed to domestication of plants and animals leading to rural settlements. Hence a couple of sites have been proved to mark their contribution in the making of components leading to advanced material life on the edge of the Indus plains.

The excavations at Kile Gul Mohammad had has reported the cultural antecedents of pre-pottery Neolithic stage.[97] The characteristic cultural components reported were microliths, structural remains of wattle and daub and domestication of the cattle, sheep and goat. The radio carbon dates, viz. 4352 B.C., 4346 B.C. and 4210 B.C. for this period have been obtained from the upper levels. [98] Below these deposits, there were cultural deposits of 4 m, indicating an early beginning of the aceramic Neolithic occupation to somewhere in the sixth millennium B.C. Period II witnessed introduction of handmade pottery of crude type, occasionally bearing basket impressions, and at times simple and wavy painted lines. Period III, introduced metal, besides wheel thrown red ware sometimes bearing designs like triangles, stars, loops etc. painted in black pigments. Period IV produced an effect of polychrome on the pottery.

Encouraging evidence comes from Mehargarh situated about a hundred kilometers southwest of Kile Gul Mohammad. It lies near the point where Bolan river comes out of the Brahuil hills and enters in the Kacchi plains. The Neolithic culture at the site possibly emerged from a locally established Mesolithic substratum. It is postulated in the light of discovery of Middle Palaeolithic tools in the glacis overlooking the Bolan river[99] with the scope of further discovery of an epi-palaeolithic assemblage which may have ultimately given rise to the Mesolithic-microlithic components of Mehargarh Neolithic complex.[100]

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[97] Walter A. Fairservice, Excavations in the Quetta valley, West Pakistan, Anthropological papers of American Museum of Natural History, Vol. 45,pl.2, pp.169-402.

[98] Possehl, G.L. (ed.) Radiocarbon Dates for South Asian Archaeology, the University Museum, University of Pennsylvania, Philadelphia, 1990, p.29.

[99] Pakistan Archaeology, Nos. 10-22, 1974-86, p.64

[100] B.B. Lal. Op. cit., 1997, p35, n1.

Faunal levels from the early levels include small quantities of bones of a number of wild species, including cattle and several species of deer and large quantities of bones of sheep and goat. The earliest evidence of grain appears to be locally domesticated wild varieties of barley and wheat. Apparently, subsistence pattern seems to be emerging between 6000 and 5000 B.C. based upon wheat and to some extent barley, sheep-goat and cattle. The proximity of the river, the abundance of game and the presence of wild cereals served as ground for the indigenous transformation in the subsistence pattern from hunting and gathering to the domestication of animals and agriculture.

Period I, characterized as a Neolithic culture, reported heavy duty stone tools comprising polished axes, adzes and chisel while lighter tools included type of microlithic tools i.e. parallel sided retouched blades, borers, scrapers, triangles, trapezes, lunates and micro borers. Evidence for the beginning of agriculture, domestication of animals, number of crafts, microliths together with mechanism to make composite sickle, bone tools, clay modeling and disposal of dead relatively compare well with the subsistence findings obtained in the central Gangetic plains and the southern piedmonts of the Vindhyas.

Among the cereals, three types of wheat, namely einkorn wheat, emmer wheat, bread wheat; two row hulled barely and six row barley indicate an early stage of cultivation in the sixth millennium B.C. This stage of cultivation was a forerunner event to the Harappan Civilization. Conspicuously, the remains of six-row barley (Hordeam Vulgare var. *rudum*), emmer wheat (*Triticum dicoccum*) bread wheat (*Triticum durum/estivum*) have come to light from the Harappan context at Kunal, district Hissar, Haryana.[101] The samples were collected from the excavated mound located along the Sarasvati river. Palaeobotanical samples included specimens of *jowar*-millet, lentil, field-pea, grass-pea, chick- pea, horse-gram,, fenugreek, linseeds, and til, besides musk, melon, cotton seed and fruits like date, grape, lemon, *amala*. Further a number of weeds and other wild taxa[102] not only throw considerable light on the vegetation in the Sarasvati-Drishadvati divide in the late half of the fourth millennium B.C. but also indicating the integration of the site into the vast interaction sphere between the settlements of Kachhi plains and the central Gangetic plains.

[101] J.S. Khatri and M. Acharya, Kunal: A new Indus Sarasvati Site, Puratattva, Vol.25, 1995, pp.84-86.
[102] K.S. Saraswat, Anila Pokharia, Palaeobotanical investigations at arly Harappan Kunal, *Pragdhara*, no.13, pp.105-139.

Likewise the mud brick sizes indicate a ratio of 4:2:1(28 x 14.5 x 7cm) coinciding with the ratio of the bricks used in the Harappan times. Similarly occurrence of bones of water buffalo (*Bos bubalis*) would be treated as the earliest evidence of domestication in the Indus plains on the lines of *Bos indicus* in the Gangetic plains.

Comparable burial types- flexed and crouching with grave goods have been reported across the Indus-plain suggesting the emergence of ritualistic attachment to the concept of disposal of dead. The grave goods included necklaces of stone or shell beads, stone and bone pendants and anklets. Items of long distance importation found in the grave included marine shell beads from the coastal region, lapis lazuli from the local source in the hills of Baluchistan and turquoise from the upper extension of Hindukush mountains.

Period II and III witnessed the creation of multi segmented structures of mud brick divided into cells with a passage in between; reminding the granary at Harappa. The craft activities experienced an increase in the percentage of wheel turned pottery bearing painted motifs of birds and animals, hatched triangles, sequences and dot-tipped lines radiating from the centre. Modified versions of these design elements continue to figure on the early Harappan pottery reported at the sites located in the Greater Indus plain including that of the Sarasvati-Drishadvati divide.

Further north of Kachhi plain, lies two noteworthy sites viz. Gumla[103] and Raman Dheri.[104] Located in an identical geographical setting as Mehergarh the sites of Gomal valley also demonstrate transformation from incipient camping to agro-pastoral settlement. Period I at Gumla apparently demonstrate aceramic Neolithic unearthed, a variety of microliths such as parallel sided blades, burins, scrappers, awls, etc., besides food processing equipments in the form of saddle querns mullers and pestles, polished stone tools however, remain absent. Presence of large pits containing ash and charcoal create impression of community oven. Period II witnessed the introduction of wheel thrown pottery, copper/ bronze. Among the plain pottery noted shapes were of cooking vessels and storage jars, while painted one included bowls with ring base, flat dishes, dish-on-stand, troughs etc. The design elements executed in deep chocolate colour, comprised faunal and geometric

[103] A.H.Dani Excavations in the Gomal Valley, 1970-71, *Ancient Pakistan*, pp. 1-177; F.A. Durrani, Some Early Harappan sites in Gomal and Bannu Valley, *Frontiers of the Indus Civilization* (eds.) B.B. Lal and S.P.Gupta, 1984, pp.505-509.

[104] F.A. Durrani, Excavations in Gomal Valley: Rehman Dheri, Excavation Report No.1, *Ancient Pakistan*, 6, pp.1-232.

motifs. Apart from this the horizon reported bone tools terracotta figurines, bangles and gamesmen. Mud bricks structures were introduced in Period III; the size of the brick was 28 x13 x7 cm (ratio: 4:2:1) analogous to the Harappan culture. Elements of the Harappan culture such as 'horned deity', terracotta figurines, bangles, antimony rod, nail paner of copper/bronze have come to light. Evidence of conch bangles suggests long distance trade with costal sites may be through intermediaries. Harappan elements such as perforated vassals, triangular cakes, toy carts, solid wheels, cubical weights, etched beads of carnelian and disc shaped beads of carnelian and disc shaped beads of paste starts occurring from Period IV.

Reverting to another site of Gomal valley, the first occupation of Rehaman Dheri is relatively later than Gumla. The site showing the sign of rectangular settlement, visibly encompassed by the massive mud brick wall, is possibly the earliest urban site such as appears to be forerunner to the Early Harappan settlement of the greater Indus system. Noteworthy find of the period is an inscribed seal with two holes, engraved with two mountain goats on one side and another two scorpions and a frog. Period II has reported pottery types ascribable to Kot Dijian variety. The design elements include the peacock, peepal leaf, intersecting circles fish-scales, typifying Indus pottery.

Further north, the Kot Dijian horizon gets attested at Tarkai Qila in the Bannu basin. From this horizon uninscribed steatite seals, bearing signs of four concentric circles and cross hatchings, have been reported, as such the use of seals in Kot Dijian context gets attested. The site at Sheri Khan Tarkai in the Bannu Basin, however, has reported the remains of Late Neolithic complex above the natural soil. Radiocarbon dates ascribe the horizon to circa 4500 B. C. the succeeding occupation is of the Kot Dijian. Similarly at Sarai Khola, Period I is characterized by polished stone axes, chert and flint blades and other microliths, and bone points. The pottery assemblage of medium to coarse type bear burnished brown surface akin to Burzahom type Neolithic pottery. The shapes include pans and bowls, Bowls with mat impression at the base is also typical to Burzahom variety. Radiocarbon dates suggest that the early period goes back to around mid-fourth millennium B. C.

Chapter 2

The Environment and Settings

A. THE ENVIRONMENTAL SETTINGS

The Haryanvi plains today form a distinct part of huge expanse of the Indo-Gangetic alluvial plain. On broader scale, the North Indian plains are divided into Thar dessert of Rajasthan, alluvial plains of Punjab- Haryana and Ganga- Yamuna divide. The Haryana distinctively stands out as a vast river-less tract spread between Sutluj and Yamuna. Though there is no perennial river in Haryana today, it was drained by a major river system in the past. The huge relict bed of Ghaggar passing through Kurukshetra, Tohna, Fatehabad, Suratgarh and finally entering in Pakistan is a testimony of the fact.



Fig.1. Ancient Rivers in the Modern Political Settings

Another dry tract today known as the Chautang was also major feeder of the Ghaggar. The Chautang river originate in Shiwalik hills and flowed through the modern districts of Kurukshetra, Karnal, Jind, Hansi and Hissar before it met Ghaggar in Rajasthan near Suratgarh. The Chautang is largely identified with Vedic Drishadvati[105].

A brief out line of present environment viz., land forms, drainage, geology, mineral resources, climate, soils, flora, fauna, agriculture and data of modern land use is discussed in this chapter, as it provides the basis for the reconstruction of the past environment and Harappan land use pattern. This data is partly based on some published sources[106] and partly on the field observations.

B. PHYSIOGRAPHY AND LANDFORMS

Topographically, this area is flat, monotonous upland plain. On broader perspective, it is part of the alluvial Ganga Yamuna plain, western portion of which marks gradual transition to the dessert. Dominant feature of topography is occurrence of aeolian sand of variable shapes and thickness overlying the Pleistocene alluvium which becomes thinner towards the western side of Hissar district. These patches of older alluvium are either exposed or occur at shallow depth beneath a veneer of sand in *tals* or topography depressions enclosed by fixed dunes.

Though the area is nearly level with barely visible slopes, microscopic examination of the topographic maps shows some exceptional topographic variations in form of the regions in and around the sand dunes and *tibbas*. The general gradient of the terrain is from north east to south west and then west. In comparison to the plains, the filled up channels with the flood plain sediments occupy relatively lower position.

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[105]Oldham, C.F. 1874, Notes on the Lost River of the Indian Desert, *The Calcutta Review,* No CXVII, pp. - 1-27.

[106] R.L. Ahuja and Mahendra Singh 1983, *Soils of Hisar District and their Management*, Department of Soils, Haryana Agricultural University, Hisar.

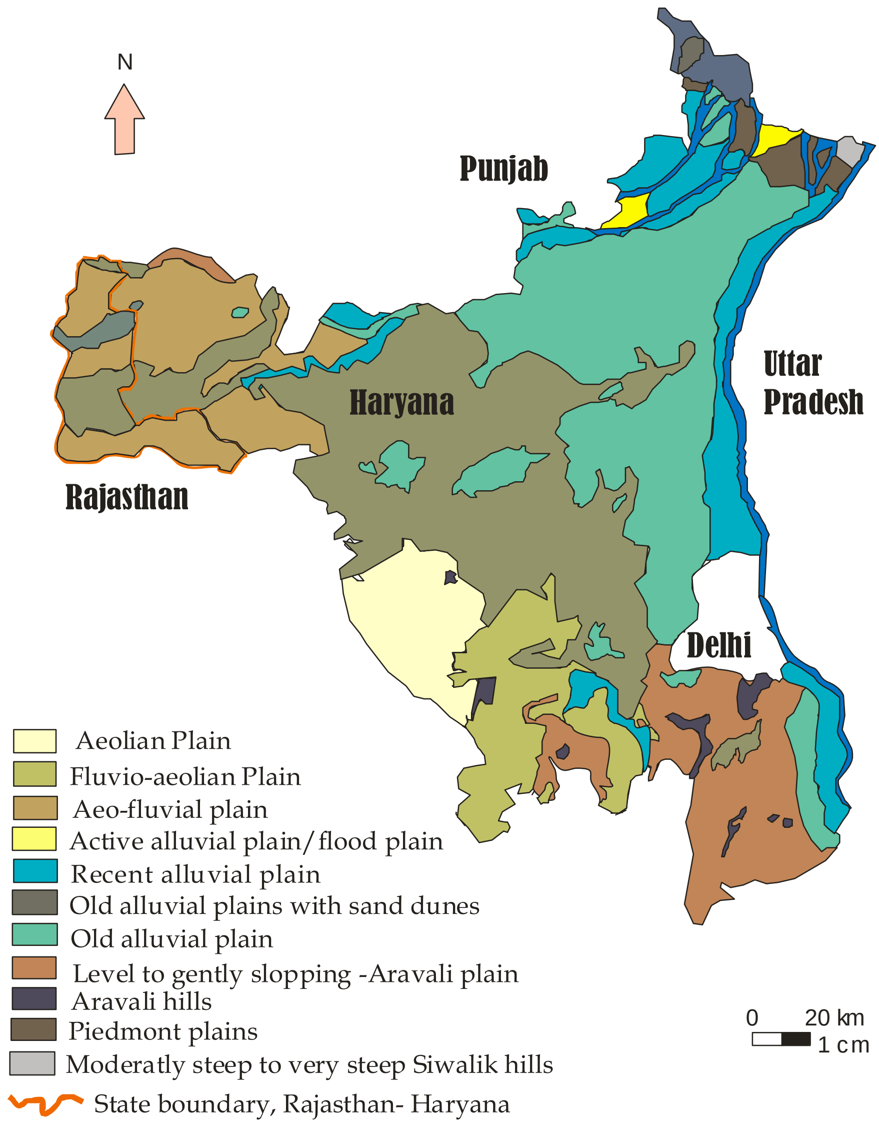


Fig.2. Physiography and Landforms

The moving and active sand dunes occur towards the south west of Rakhigarhi. At some places, extensive grazing and deterioration of scan *Acacia* vegetation on the slopes of stable sand dunes has reactivated the dune building activity. The active and sub-active dunes are sub-recent in age. Almost all the fossil dunes carry a buried soil profile. The deeply weathered soil profile, dark brownish to red in colours is decalcified and faintly acidic in nature which suggests two extremely dry phases separated by humid climatic phases in the late quaternary period when the dunes were formed[107].

[107] Hissar District Gazetteer

The soils of Hissar district have been laid by aeolian and fluvial processes. By the fluvial action of sediments of old relict of Chautang River have caused differences in physiographic positions. Aeolian sediments through wind action migrating from the western desserts of the neighbouring Rajasthan state have been deposited by the various landscapes. Therefore, due to these two processes alternate layerings of the aeolian and fluvial sediments have been observed at the lower depths of the soils.[108]

On the basis of various patterns and photo-elements the Hisar district is classified by Ahuja [109] in four major plains, viz. Aeolian plain, Upper alluvial plain, Drishadwati flood plain and Ghaggar flood plain. The catchment area of Rakhighari comprises only two physiographic units- Upper Alluvial plain and Drishadwati Flood plain. The Upper Alluvial Plain is consists of partially stabled to unstable, moderately to severely eroded sand dunes. Plains of aeolian sand are also noticed. The old relict course of river Drishadwati filled-up with the sediments and has been under cultivation with many soil problems. The river in the recent past flowed through Jind, Hansi and Hissar before it met Ghaggar in Rajasthan.

C. SOIL SERIES

The suitability of soil for agriculture seems to have been an important factor when Harappans selected the location of their settlements. A macro-environmental survey of the region around Rakhigarhi has indicated that most ancient mounds were situated on the edge of the Chautang river flood-zone. The modern data of soil distribution[110] for the state of Haryana is taken into account and described below:-

1. Jallopur series- The soils around Rakhigarhi and towards south east have been categorized under this series. Jallopur series have yellowish brown, sandy loam in upper horizons, sandy loam to loam moderately developed with patchy thin flood coatings and it is noncalcarious, nonsaline in the

[108] R.L.Ahuja and Mahendra Singh, 1983, *Soils of Hissar District and their Management*, Hissar,p.19.
[109] R.L.Ahuja and Mahendra Singh, 1983, *Soils of Hissar District and their Management*, Hissar,p.21.
[110] R.L.Ahuja and Mahendra Singh, 1983, *Soils of Hissar District and their Management*, Hissar, pp. 29-59. .

lower horizons. These soils have developed on flood plains with slope less than one percent.

2. Ninanda series- Soils under this category are spread towards north-western part of Rakhigarhi. These soils have pale brown (dry) and brown (moist) loamy san in upper horizons, brown to dark brown nonsaline, nonsodic, sandy loam, weakly developed and moderately calcareous in the lower horizons. Presence of oxidation-reduction mottles at lower depths indicates the influence of water table and its fluctuations. They occur on very gently sloping cultivated plain with aeolin cover.

3. Rawalwas Series- Rawalwas series have brown, loosely packed single grain, loamy sand in upper horizons, yellowish to dark yellowish brown, nonsaline, nonsoditic, calcareous loamy sand in lower horizons. They occur on raised, moderately slopping, stabilized, cultivated, well drained aeoline plain with scattered appearance of dunal hammocks. They have also developed on old alluvium overlain by aeolin sandy material or inter-dunal flats. These soils occur in isolated pockets in catchment area of Rakhigarhi in northwest and southwest.

4. Behel Series- These soils have yellowish brown sandy upper horizons, and brown to dark yellowish brown, nonsaline, nonsodic, nonsticky, nonplastic in lower horizons. They occur on un-dwelling terrain of partially cultivated, partially stabilized to unstabilized severely eroded, excessively drained sand dunes of aeolian nature. Uncertainty of rains, higher evapo-transpiration and common dust storms in summer season are the main factors of crop failure. Due to these conditions these soil have bee placed under arid moister regime. The occurrence Behel series is noticed in the northwest and southwest of Rakhigarhi.

*5. Shamri series-*These soils on surface have white incrustations of salts, brown colour and loamy sand texture. The lower horizons are brown to yellowish brown in colour and sandy loam to loam in texture, moderately to strongly saline , moderately saline and non- calcareous in nature. They occur on plain salt affected lands, high in water table for most of the period causing capillary rise and salt incrustations on surface. Isolated pockets of these soils are noticed in the south-western part of the catchment area of

Rakhigarhi. Each category of soil support peculiar vegetation (appendix I) and promote certain land use pattern.

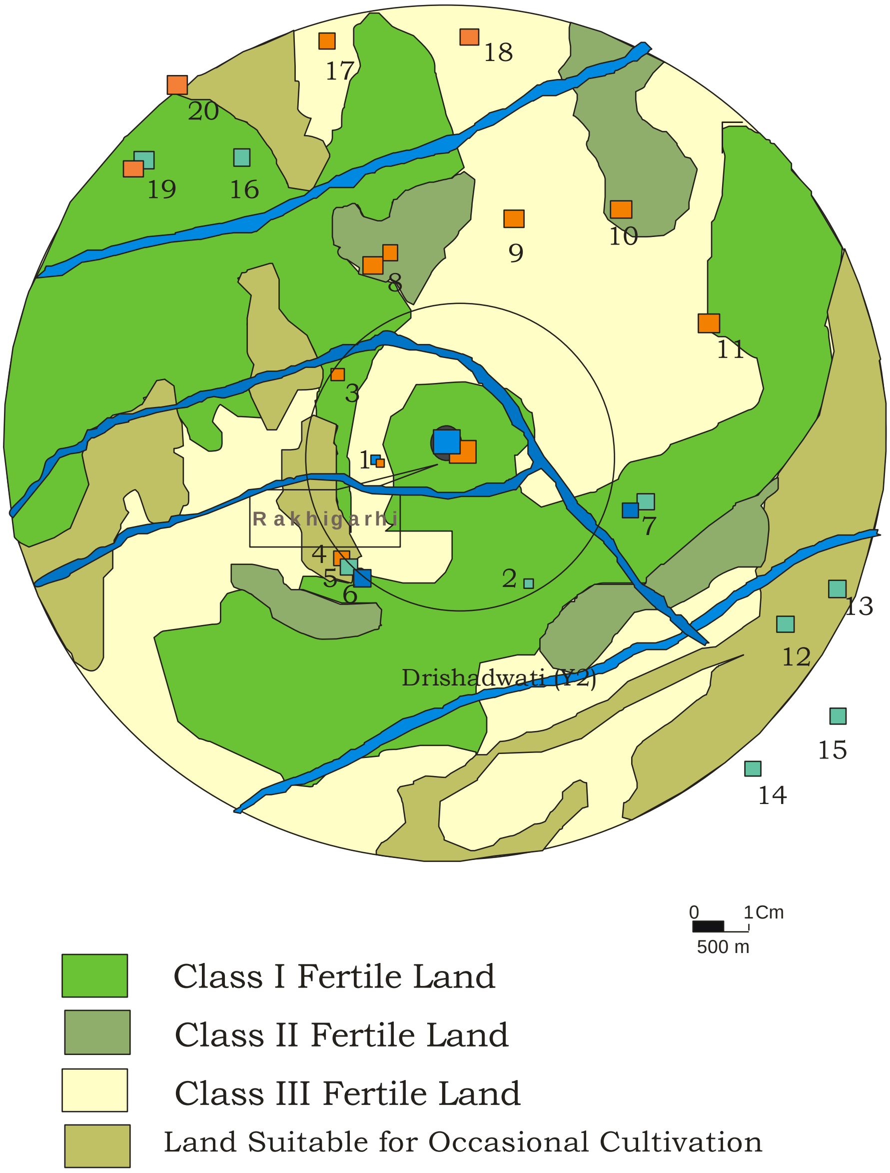


Fig.3. Soils in the 15 km radius of Rakhigarhi

D. GEOLOGY

The Hissar district is a part of Indo- Gangetic plain which was developed in a sag in the crust of the bedrock resulted from the upliftment of the Himalayas. The sag or depression has since filled up by sediments deposited from the rivers and channels of northern Himalayas and southern Aravali hills from Pleistocene to recent time.

The sub-surface geology of the area has been a conjecture for a long time, as the alluvium effectively conceals the solid geology of the floor. The

whole expanse of the alluvial plain with relict channel beds within which the Saraswati, Drishadwati and Ghaggar rivers have occasionally shifted their beds in Holocene times, are covered by aeolian deposits in the recent past with increasing aridity. Some of the great rivers of Pluvial age such as Saraswati and Drishadwati also known as Chautang have moved away leaving inter-locked alluvial plains along its receding course, which was later converted into aeolin deposits and gives a present landscape scenery within varying monotonous plain having relict channel courses, levees, bars, paleolakes depressions and sand dunes.

The exact depth of the alluvium is not known, but from many geophysical and bore hole data, it varies from 100 m to more than 400 m in cross sections. These sediments are mostly calcareous with high percentage of silt and fine sand with yellow colour.

Thus, hard rock geology of this area is concealed under alluvial and aeolin deposits. The alluvial deposits of quaternary age are divisible into newer and older. The former occurs in active flood plain of the Ghaggar river and other is ancient channels of the Drishadwati or Chautang filled with riverine sediments comprises sand silty clay and occasional gravel. The concentration of calcareous sediments in various proportions is found mixed with other constituents. The sediments are heterogeneous in character and are deposited on a basement of metamorphic and igneous rock of pre-Cambrian age. The bed rock slopes towards northeast over which the alluvial deposit rests. The aeolian deposits comprising accumulations of sand blown from Thar dessert of Rajasthan are mostly confined to south-western side of the Rakhigarhi. These sand accumulations occupy vast stretches of land and occur in shape of sandy flood mounds and ridges, also in dune shapes over the sandy floods.

E. GEOMORPHOLOGY

Himalayan uplift in the north with the down wrap of the pre-Cambrian shield in the south, leading in fluvio-glacial sedimentation of sag between, during Pleistocene times, resulted in the vast stretch of Indo-Gangetic alluviam. A third one in between the two above system mentioned,

flowed through Punjab, Haryana and Rajasthan to meet Arabian Sea in Kutch, Sutlej, Ghaggar, Chautang (Drishadwati) were the tributaries of it. The Saraswati and Dirshadwati or Chautang originating in Simur area used to flow through Jind, Hansi, Hissar and then after catching Ghaggar at Hanumangarh and Bhatnar used to flow southwardly independent of Indus river.

Either due to the uplift of the Himalayan in relation of Siwaliks, the feeding glacier got cut off, or because of the increasing aridity in Rajasthan and adjoining areas, the moving sands choked the Saraswati and Chautang rivers of Haryana. The relict channel beds are more or less low plains with raised level portion occupied by the canals, introduced parallel to the earlier course. This is one of the reasons to disturb the hydrostatic balance, rise in the water table and resultant salinity alkalinity in Jind, Hansi and Hissar belt.

Presently, only Ghaggar is a seasonal river flowing in the north Haryana with no other live streams left. The Ghaggar is also shifting laterally, too frequently, leaving many relict channels, bars, interlocked levees and basins. The area between the Ghaggar and old relict course of Chautang (Drishadwati) is relatively a raised upland plain. It is covered indiscreetly with aeolian particles. Northern, southern and even eastern to some extent, has saline-alkaline patchy zones.

Present landform is more manifested to aeolian deposition in the prevailing wind direction from southwest to northeast and also got disturbed of the old sediments along the channels, levees, bars etc. The geomorphic processes that have been acting upon this region are -

Organic: uplift of the Himalayas and the resulted into through or sag, north to the Aravallis.

Fluvio-Glacial: After Pleistocene glaciations and subsequent melted glaciers flowing as rivers.

Fluviatile: During high rainfall, number of rivers flowing, braided drainage and (Pluvial) deposition, filling up of the trough.

Fluvial: Major stream network developed on more or less levelled alluvial plain.

Fluvio-Aeolin: - Glacier feeding cut off at the source of the streams and choking of the river north with aeolian[111].

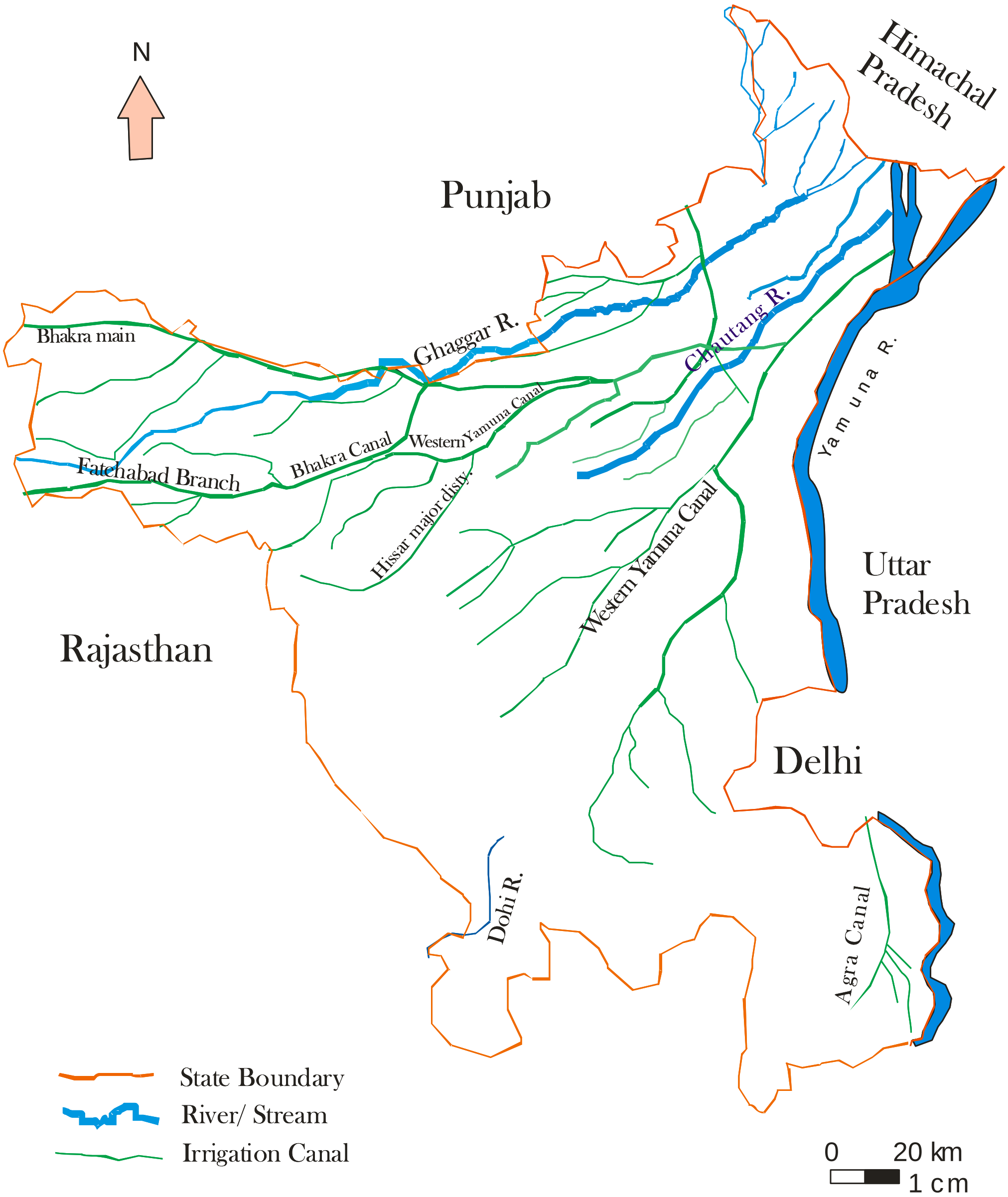


Fig.4. Modern Drainage Pattern in Haryana

F. DRAINAGE SYSTEM

The Haryana plain is divided between Ghaggar and old relics of Drishadwati tract and its vast filled channel course is occupied by the Hansi

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111 R.L. Ahuja and Mahendra Singh, 1983, *Soils of Hissar District and their Management*, Hissar, pp.6-7.

branch of the Western Jamuna Canal. The Ghaggar is the largest seasonal stream in Haryana deeply incised alluvial channel, today it's a misfit stream since the scan volume of discharge stands in marked contrast to its large channel width. The river drain large column of flood flow during the rainy season mostly between July to September and it is generally dry in summer. However, in flow of ground water takes place till late as October. The Ghaggar was once important river system of the north-western India during the Pleistocene period. The hydraulic changes resulted into drying up of river. The Yamuna and Sutlaj which formed eastern and western tributaries of once mighty Ghaggar river system deserted the parent river; which got completely dried up; and at present has left wide threats of flood deposits.

At present, there is no perennial or seasonal river stream flowing through the area around Rakhigarhi. Due to absence of major or minor rivers; canal irrigation becomes main source of irrigation for modern agriculture. In the Hissar districts of Haryana, canals cover about 92% of the total irrigated area. The remaining 8 % receive well and tube well irrigation because of the poor quality of the sub-soil water in the district.

But for domestic purposes, people mostly depend upon tube wells, lakes and canal irrigation. The ground water occurs in a thick zone of saturation in the alluvium. The depth of water table generally ranges from 0.83 + 39.80m. The subsoil water of this area is overall brackish. The quality of the water varies from place to place and from well to well. The sweet water is found from wells located in areas having ameliorating factors like existing or old stream courses, long standing irrigation seepage from *kachcha* tanks.

At some places well situated on bare dunes of loose shifting sands yield good quality of water because most of the rain water is unable to flow, sinks underground to improve the ground water by dilution. But at some place water level is very deep almost (15 to 20 m) and more from the surface; here water is saline and unfit for domestic consumption and agricultural purpose. Thus, extensive canal irrigation introduced by Bhakra Nangal project remains major source of water today. But the most important factor here, which should be taken into account, is that the modern canals are

built in the depressions of the ancient river tracts. A canal of Bharawala branch, which enters from north east of Narnaund and goes towards Hansi, is also built upon the ancient dried up bed of Drishadwati river.

G. CLIMATE

This area experiences a subtropical, continental secondary, monsoonal type of climate[112] with prolonged hot period from March to October and fairly cool winters. However, extreme temperature fluctuations may occur within a very short time interval. Further, the year may be divided into 4 seasons. The cold season from November to March is followed by the summer that lets up to the end of June. The period from July to about the mid of September is southwest monsoon season. The later half of September and October constitute the post monsoon of transitional period. In all, its dryness and extremes of temperature and scanty rainfall characterize the climate of the study area.

a. **Rainfall:** - The rainfall is most dominating and important climatic factor in relation to dry land plant growth. Rainfall of the Hisar and Jind districts is highly erratic; variable and therefore its amount, distribution and intensity during the crop growth season are highly important. The average annual rainfall in the Hissar district is 395.6 mm. About 71% of the annual normal rainfalls are received during the short southwest monsoons period, i.e. June to September. In the post monsoon season, few light showers i.e. 10 to 15 % of the annual rainfall are received from westerly depressions. The monthly data of the rainfall could be understood in a better way with the help of table (Table No.).
b. **Air Temperature:** - There is rapid increase of temperature after February. The mean daily maximum temperature in May which is hottest month is 41.6 ^{0} C. On individual days, the maximum temperature during the summer season may rise up to about 47 ^{0} C to 48 ^{0}C. Hot winds flow in summer steadily from west with frequent dust storms; sometimes-occasional thundershowers are also seen. With the advance of the monsoon by about the end of June, there is appreciable drop in the day

[112] R.L.Ahuja and Mahendra Singh, 1983, *Soils of Hissar District and their Management,* Hissar,pp. 8-10.

temperature and weather becomes cooler during the daytime, but the nights are even warmer than those during the summer season are. As the moister gets added in monsoon air, the nights are often uncomfortable. After the withdrawal of the monsoon in the later half of the September the temperature began to decrease. The decrease in temperature in rapid after October and the drop in temperature after rainfall is particularly evident. January is generally the coldest month with the mean daily maximum of 21^0 -7^0 C. In the cold season (Jan. and Feb.) the district is affected by cold waves in the wake of passing western disturbances and the minimum temperature drops down with an average of 1-3 ^{0}C occasionally.

c. **Soil Temperature: -** Monthly mean temperature at different depths presented in table (Table No.) indicates that at shallow depths the afternoon readings are appreciably higher in summer attaining mean temperature of about 46.5^0 C in May with an extreme value of 59.4 ^{0}C. However in winters, soil temperature around 1^0C has been observed in December to February month at the surface soil. The soil temperature starts decreasing in July with the perception on monsoon rains. An average temperature of 30 ^{0}C is available at early hours of the day to carry out the field operations of Kharif crops in July with minimum loss of the available soil moisture in dry land. An average soil temperatures of 16^0 to 21^0 C exists during the winter season which is quite favourable for cultivation of thereby crops like *guara*, *raya*, season, wheat, barley, peas etc.

d. **Winds:** - These are generally light; as an average wind speed of about 7 km per hour has been recorded during the past many years. Monthly mean wind spin ranges from 4 to 10 km per hour. Occasionally westerly wind velocities of more than 50 to 60 km per hour have been observed in the day month of May and June. This creates an extreme moister deficiency and soil erosion problems in the region. During the winter season north-westerly cold winds of 10-20 km per hour have been recorded occasionally. In the post monsoon and winter season, south-westerly or westerly winds are more common in the mornings; northerly

and north-westerly are predominant in the afternoon. In the summer, winds are more common from the west or southwest in the morning. In the afternoons, they are mostly from directions between west and northwest.

e. Relative Humidity and Vapour Pressure: - There is large variation in vapour pressure and relative humidity in the morning is generally high during the monsoon and winters (Dec. to Feb.) usually being about 70% or more. Humidity is comparatively less during the rest of the year, the drift part of the year during summer season with the relative humidity being about 30% in the afternoon.

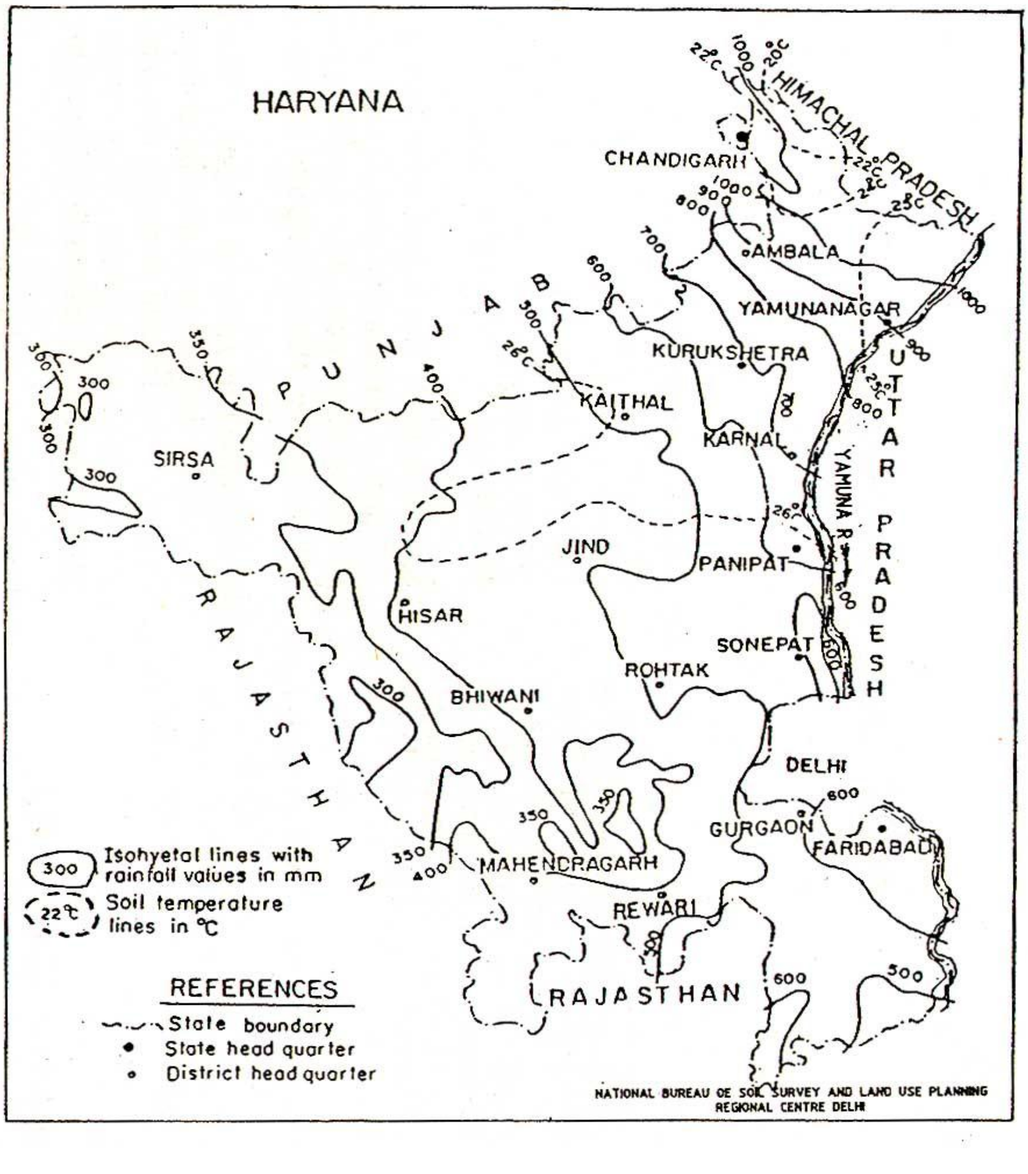


Fig.5. Rainfall and Soil Temperature of Haryana

H. NATURAL VEGETATION AND FLORA

The Punjab (and Haryana) plains are a least forested area with 3.4 % natural vegetation cover. Its prevailing aridity and long human occupance have been responsible for its poor vegetation cover. In the remote past there were extensive areas covered with natural vegetation, particularly in the southeast (Haryana) much of which has been removed.[113]The forest of this area falls under category of tropical dessert thorn and comprise predominantly of *xerophytes*. Flora is scanty and sparse; three species are found in forest cultivated fields, waste lands and around habitation *'jand'* or 'j*andi'* is the most common tree found in these dry tracts. Its, wood is used or making agricultural implements. *Rohera, khhairai, reru, barch, kikar, imly, banana, peepal, shisham* and *neem* are some other trees found in this area.

The natural vegetation found usually is tropical thorn forest, consisting of plants like *kikar, quaker* and *jand beri* is the most important bush. Common shrubs are bans, *vanvar, babhool, mallah, karir, phoa, khip* and *ak*. Some medicinal herbs like *bansa, kharuti, bhakhra* and *dhattura* are also found. The most important natural vegetation of the districts are the greases, such as '*dhaman'* use as feed for cattle and often preserves hay, '*chimber*' or *khorimber*, *kheri* or *kur*, *duchab*, dub and *sarkanda* are also fodder grasses found on waste lands.

I. FAUNA

The reclamation in recent years of vast areas of scrub jungle and waste land the ever growing pressure of population has a disastrous effect upon wild life. This process of deforestation has naturally affected the wild animal in the region and at present they are reduced to low numbers. Despite of reduction in number variety of animals found around Rakhigarhi is quite good[114].

a. **Mammals:** - Bandar and common *langur* represents the primate group. Big cats like tiger, leopard, panther etc., which were here in good number,

[113] Singh R.L. (Ed.) 1999, *India a Regional Geography*, National geographical Society of India, Varanasi.p.93
[114] District Gazetteer Hissar

are no more seen. The carnivorous found here are: the jungle cat, the small Indian civet, the common mongoose, jackal and the Indian fox. The *Chuchunder*, two species of bat- the common yellow bat, and the Fickell's bat are usually seen. The five stripped palm squirrel or *gilehary*, *sahi* or the Indian porcupine, the Indian common house mouse and rat, are the common rodents found. *Chinkara* or ravine deer is also seen, but its number is decreasing. Black buck and the bluebull or *nilgai* are also found.

b. **Birds:**-A large number of game birds, some of them are residential and found throughout the year while other are winter visitors. Various types of dukes and geese such as eastern grey leg goose, bareheaded goose, common shell duck, pintail, common tail, mallard, godwall, wigion, bluewingaed teal, shoveller, common pochard, ferruginous duck, tufted duck, some other ducks such as comb duck large whistling teal, tree duck are found throughout the year.

Other game birds like partridges and quails are common, Indian black partridge and grey partridges are seen. Grey quail is a winter visitor, while black breasted or rain quaril, jungle bush quail and rock bush quail. Indian yellow legged buttonquail and Indian bustard quail are resident species. Sandgrouse, namely the Indian sandgrouse, has been noted as resident bird while large pintail sandgrouse, spotted sandgrouse, Imperial or black bellied sandgrouse visit in the winter. Among the pigeons and doves, Bengal green pigeon is found in the vicinity of villages chiefly on ficus trees and blue rock pigeon occurs in almost all the villages. Western turtledove is a winter visitor. Indian ring dove, Indian red turtledove, Indian spotted dove, Indian little brown Senegal dove, and Indian emerald dove are generally found in all cultivated fields. Scavengers like parish kite, *brahmany* kite, white backed vulture, king vulture, towny eagle, greater spotted eagle, white eyed buzzard eagle, house row, Indian jungle crow keeps the area cleaned of dead animals by feedings on them. The Indian scavenger vulture besides feeding on dead animals, consumes a large quantity of human excreta. Predators like black winged kite, Indian *shikra*, laggur falcon, s*ahin* falcon, red headed merlin and kestrel are residential

birds. Others like booted hawk eagle, eastern step eagle, pale harrier, montages harrier, are the visitors. These along with spotted owlet eagle, owl, and mottled wood owl keep a check on the population of not only rodent pests but also various insect pests by eating them. The colourful birds add to the beauty of wild life; blue joy, northern green barbet, coppersmith, northern golden backed wood peckers, large Indian parakeet, rose ringed parakeet pied crested cuckoo, *koel*, small blue, kingfisher, white breasted kingfisher, Indian pied kingfisher, redvented bulbul, verdure flycature, Indian magic, robin, Indian purple sunbird, *lalmunia*, Indian spotted *munni* and crested bunting etc. The national bird of Indian common peacock is quite common and is seen in orchards, fields and gardens. Some attractive birds as hoop, Indian small green bee eater, Indian white eye on baboona are also seen in and around the villages. Different types of storks, cranes, egrets, and lapwings are also found.

Apart from this, it may not be out of place to present an inventory of 161 species of 111 genera from 47 families belonging to 16 orders of birds based on occasional bird watching by Yadav and Maleyavar.[115]This inventory has served as a source to the study of bones of birds retrieved in the stratified context from the excavations at Rakhigarhi, inter alia, the inventory has served as tool in the reconstruction of environmental Rakhigarhi during the Harappan times.

c. Reptiles:-Snake- The poisonous snakes like common Indian krait, Russel's wiper, *phoorsa*, and other snakes like blind snake, Indian python, Job's sand boa wolf snake and rat snake are found.

Lizards- Common lizard is seen in the house, *kirka* or *girgit* is found in lawns and hedges and attracts attention by changing colours. *Sanda* is found in sandy areas.

d. Amphibian: - Two Species of tortoise are found. Indian bull frog, Indian cricket frog, Indian burrowing frog and common toad are the rarities of frog speakers, Feather backfish, parrikatla, migal, chunni.

[115] J.S. Yadav and R.P. Maleyvar, 'The Birds of Haryana', Journal of Haryana Studies, Vol.X, 1978, Kurukshetra, pp.38-51.

e. Fish:-Bata, *siria*, *rohu, magur, singhara, ghally, mallee,* snake headed fish are the common varieties of fish.

J. Dispersal of the Modern Population and Pattern of Urbanization

The average density of population in Haryana is recorded as 478 persons per square kilometer in 2001. The density is more than 600 persons per square kilometer in the districts of Faridabad, Panipat, Ambala, Gurgoan and Sonipat while it ranges between 451 and 600 in Yamunanagar, Kurukshetra, Rohatak, Panchkula, Karnal, Jhajjar and Rewari. It is below 451 in Hissar, Jind, Bhiwani, Fatehabad, Sirsa, Mahendragarh and Kaithal (Gulati 2005:6).[116] The density of population is influenced by various factors such as productivity of soils, climate, topography, industrial development, urbanization, irrigational facilities and other factors of economic development of the area and is also associated with religious and historical importance of the region.

Rural Population accounts for 71.08 % percent while State's urban population constitutes 28.92 % percent only (Gulati 2005:7). The distribution of rural population relate mostly to the productivity of the soil. In the areas of Panchkula, Yamunanagara and Ambala the population is concentrated along the rivers where small patches of cultivable land and water for irrigation is available. The districts of Sirsa, Hissar, Bhiwani and southwest part of Jhajjar which have sand dune and brackish water are relatively sparsely populated. The Arawalli hillock comprising Gurgoan, Rewari and Mahendragarh is another pocket with sparse population due to its semi-arid conditions; sandy soils combine to impede habitation and cultivation. The eastern belt of the state along the Grand Trunk Road which receives more rain and where soils are better in quality is thickly populated than the western parts (Gulati 2005:44). Much of this part of Haryana is largely rural, the eastern part of Haryana has fast growth rate of the urban population. The Yamunagar, Karnal, Hissar district centres have higher percentage of urbanization due to industrialization. Being a religious and educational centre Kurukshetra has higher number of urban population.

[116] Gulati, Sunil 2005, *Census of India 2001: Haryana Administrative Atlas*, Government of India

But on the larger scale, western and central Haryana have maintained its rural character as compared to south Haryana- Gurgoan, Faridabad.

Among the working population 'Main Other Workers' is labor force which is not engaged in basic subsistence activities like cultivation constitutes 52.17% of the total working force. Industrial development and opportunities in the service sector are the main factors responsible for this change. The 35.64 % of the total working population is categorized as 'Main Cultivators'- land owners engaged in cultivation with effective supervision (Gulati 2005:60). Only 9.74% of the total working population falls under the category of 'Agricultural Laborers' (Gulati 2005:62). Besides these major categories 2.45% of the total working population is engaged in Household Industries (Gulati 2005:64).

K. Agriculture and Modern Land Use Pattern of District Hissar-

To cover more regional perspective data of Hissar district is taken into account. Hisar district is primarily an agricultural district. Most of the soils of the district are suitable for cultivation. The rainfall of this area is scanty and uncertain. Therefore, whatever water or irrigation is available it is being utilized judiciously and rationally. A considerable part of the district needs soil moister conservation practices and dry land technology for harvesting good crops.

The utilization of land in Hisar district during the period of 1970-71 to 1980-81, is discussed here. About 83% of the geographical areas of the district are under cultivation. Only 1.2% is under forests and the remaining land is not cultivated. The area under forests is increasing slowly. The area under barren land uncultivable wasteland has been reduced from 5 to 0.9 %.

Cotton, *bajra*, wheat and grams are the major crops in the district, occupying more than (76%) of the total cropped area. Gram covers the maximum area (23.4%) followed by *bajra* (21.4%), wheat (15.8%) and cotton (15.6%). Rabi oilseeds occupy a little over 4% of the total cropped area of the district. Economically the most important crop of the district is cotton; and the production of cotton in 1977-78 was 220 thousand tones. The share of

the district to cotton area and production of the state was 46.99% and 47.27% respectively and the district was termed as the cotton belt of the state. Another important crop of the district is oilseeds which are grown as Rabi crop.

Other Crops: - New varieties of fodder crops like *chari*, Sudani grass are introduced. With increased facilities of irrigation there is shift toward vegetable crops also. In 1977-78 vegetable crops covered 2,650 hectors with chillies and potatoes the principle vegetable crops of the districts, constituted about half of the total vegetable area of the district.

L. Animal Husbandry: -

The Hisar district is renowned for its Haryana breed of cattle and Murrah Breed of buffaloes and hold unique position in India. According to 1977 livestock census the livestock; population of the district was 8.12 lakh which accounted for 11.9% of the livestock population of the state. The livestock density works out to 128 animals per square kilometre. Buffaloes had significantly larger population and accounted for 40% of the total livestock population of the district. The population of sheep was largest in the state and these were 18% of the total sheep population of Haryana. On the poultry side, there are 60 birds per thousand people in the districts as against 122 in the state. In sum, the position of the village on an average is that it has 567 cattle and 671 buffaloes, besides other livestock and poultry.

M. Rock and Mineral Resources

Though surface geology of the Haryana plains is dominated by alluvium plains and aeolian sands; these deposits are met with Pre-Cambrian rocks surfaced in Bhivani, Hissar, Mahendragarh and Gurgoan districts. The rocks present here are divided into the Aravalli system, Railo series and Delhi system. The Aravalli region form long and wide synclinorium in the basement schistose gneisses of Rajputana. The successive formation is termed as Raialo series. This series is rich in crystalline limestone; associated with it are quartzites, grits and schistose rocks. Raialos are succeeded in the northern part of the Aravallis by another

unconformity known as Delhi series. It comprises quartzites, grits and schistose rocks. Delhi system of rocks is further divided into Alwar series consisting pinkish purple quartzites, Kushalgarh series with limestone and Ajabgarh Series comprising slate, mica schist, limestone and ferruginous quartzite. Both the Alwar and Ajabgarh series are frequently intruded by a few basic rocks as well as by granite and quartz veins. The Tusham granite hill which crops out in the Bhiwani district is considered transitional stage between normal granite and quartz porphery.

The 'plains' proper do not contain minerals except *kankar* deposits along the high banks of rives. The hilly regions especially Aravalli tract in the south possess deposits of iron. The Mahendragarh district of Haryana is very rich in minerals Iron ores are found from Dhanauta, Dhancholi, Anti-Chhapra-Kamania and Soela area. The copper-ores are widely distributed in the district from Khalra-Datla Hills and Ghatasher and numerous locations from southern portion of Narnaul. Teejanwali Hill, nearly half a mile from Rest House of Narnaul, was the copper mine in ancient times. Copper ore-with malachite occurs near the localities where the calcite quarries have been opened. Other important minerals found in this locality are manganese, mica, asbestos, barites, garnet, calcite, marble, quartz, feldspar, and kynite. Teejanwali Hill has also reported small amount of silver from copper-ores. The gritty quartzite of Alwar series of delhi system are the source of foundry sands and they are being quarried from Anangpur. Salt peter occurs at many places from Hissar and Karnal districts in water logged soils (Gupta V.J. *et al* .1969:42-56).[117]

N. Reconstruction of the past environment in the Chutang Basin

a. Hydrological Changes

The present data on the environmental conditions around Rakhigarhi is not sufficient as environment is modified to a great extent since the Harappan times. The Harappan culture grew up in a particular kind of environment provided by two great rivers flowing through desert and having

[117] Gupta V.J. and R.C. Kumar, 1969, Geology and Mineral Resources of Haryana, *Journal of Haryana Studies*, Vol.1, No.1, Kurukshetra. Pp. 42-56.

limited parallels in the world. It was spread over the vast plain between the piedmont regions of Afghanistan and Siwalik hills in India. It was essentially riverine, spread along the Indus and dried up banks of Ghaggar river systems. Though this area generally falls under semi-arid alluvium plain category, it comprises several physiographic complexes, local variations, macro and micro environments with several geographical pockets. As mentioned before, these geographical features have remained basis for the division of entire Harappan Civilization into seven domains.[118] The Chautang basin was a part of the Ghaggar river system. Since 3rd millennium B.C. major changes evident in the environment of the Indus-Ganges divide were also reflected in the Chautang basin.

The earliest attempt to identify the course of ancient rivers geographically was by Major C.F. Oldham.[119] He also attempted reconstruction of chronology of river flow on the basis of ancient literature, right from Vedas, *Puranas*, *Mahakavyas* to the Medieval historians.The most important observation of Oldham was identification of the Hakra as the dried up bed of the Ghaggar, which rises in outer Himalayan ranges (now called Siwaliks) between the Satlej and the Jamuna. He was the first scholar to associate the Chitrang (Chautang) which joined Ghaggar with the Drishadwati of the Rigveda and Mahabharata. Firoz Shaha Tughlaque, ruler in 14th century made several attempts to remedy the desert conditions of Sirsa and Hissar by bringing water into these old river beds by digging canals, Oldham also refers to Chitrang being converted into an irrigation canal. Further R.D. Oldham pointed out role of the Yamuna as a contributor to the flow of Ghaggar as he traced the dry bed of the Sotar (Hakra) as far as Tohana in the Hissar district, where the point of junction of the two great fans of the Jamuna and Sutlej respectively is situated.[120]

The mounds marking ancient cities and towns mentioned by C.F. Oldham were explored by Tessitori and Stein in pre-independence period of

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118 Possehl G.L. 1997. Climate and the Eclipse of the Ancient Cities of the Indus, in *Third Millennium BC Climate Change and Old World Collapse* (H.L. Dalfes et al. Eds.) Springer, Berlin, pp.- 193-243.

119 C.F. Oldham 1874, Notes on the Lost River of the Indian Desert *The Calcutta Review,* No CXVII, pp. - 1-27.

120 R.D. Oldham 1886, On probable changes in the Geography of the Punjab and its Rivers: An Historico-Geographical Study, pp.322-343

India. H. Wilhelmy was the first scholar who proposed this idea of shift of water from the Chautang to Yamuna. [121] Further, D.N. Wadia proposed that Yamuna flowed through the Punjab in the Vedic era under the name Saraswati. [122] In the course of time Yamuna took a more easterly course and untimely merged into Ganges at Prayag. H.T. Lambrick also states that the Jamuna was at one time a contributor, by way of the ancient bed of Chitang, itself a mile wide, slipped off the ridge to the eastward.[123]

Robert Raikes, a hydrologist from Italy made important observations about probable cases of 'death' of Kalibangan. He noticed similarity in mineral content found in the bed of present day Yamuna and course grey sand found 11 m. below the present flood-plain level of Ghaggar near Kalibangan. According to him capture of Yamuna across its flood plain under the influence of *coriolis* force (deflection force due to earths rotation) resulted in a right bank avulsion near Indri. He has given a table proposing chronology of shift of Ghaggar as - Westward diversion to Indus 2500-1750 B.C., Eastward diversion to Ganga 1750-1100 B.C., Westward diversion to Indus 1100-500 B.C., Eastward diversion to Ganga 500-100 B.C., Westward diversion to Indus 100 B.C. -100 A.D., Eastward diversion to Ganga in about A.D.500.[124]

Yash Pal and Baldev Sahai on the basis of visual interpretation of the Landsat imagery underlined the growth of the Harappan Civilization in Indus-Yamuna divide upon availability or lack of water. [125] Another key proposition was that the other major river system contributing to the Ghaggar was the Yamuna. The chronology of the geo-cultural events was also defined. The Ghaggar was considered as living river during the pre-Harappan (2500- 2200 B.C.) and the Harappan (2200-1700 B.C.) times (now 3200 B.C- 2600 B.C. and 2600 B.C. - 2000 B.C. respectively). The Chautang was considered as the living river even during the Late Harappan times. The

[121] H. Wilhelmy 1969, Urstromtal am ostrad der Indusebene und der Sarasvati-problem. In, Karlheinz Kaiser, ed., Glazialmorphologie, Glacial Morphologie. *Zeitschrift Fur Geomorphologie*, 8:76-93

[122] D.N. Wadia 1966*Geologyof India*, New York:Macmillan2

[123] H.T. Lambrick 1964, Sindh: A general introduction. History of Sindh Series, Vol.1 Hydrabad (Pakistan) Sindhi Adabi Board

[124] Robert Raikes, Kalibangan: death from Natural Causes. Antiquity 42:286-91

[125] Yash Pal, Sahai B. Sood R.K. and Agrawal D.P. 1984, Remote Sensing of the 'Lost' Saraswati River, *Frontiers of the Indus Civilization,* New Delhi, pp.-491-97.

authors suggested that north western Rajasthan was a much greener place in 4-5 millennia B.C. with Saraswati flowing through it. It's 'death' into a lake was attributed to weaning away of its main feeders- the Satluj and Palaeo- Yamuna, by the Indus and the Ganga, respectively.

The idea of Protohistiric Ghaggar-Hakra and Chautang being the Himalayan rivers was further supported and elaborately perused by scholars like Rafique Mughal[126] , S.P.Gupta[127], V.N. Misra[128], M.N.K. Puri[129], Kalyanraman[130] and K.S. Valdiaya[131]. The Indo- French archaeological Mission set up in 1982 expressed possibility of existence artificial irrigation or canal systems in the Ghaggar region.[132]

The occurrence of grey Yamuna sands just below the present day flood plain in surroundings of Mitathal, a Harappan site in Bhiwani district of Haryana, reported by Suraj Bhan led to conclusion that Yamuna was initially flowing (in the Chautang).[133] Marie-Agnes Courty has differentiated this thin section of grey loamy sand as product of seasonal floods originated from Siwalik hills. [134] The Yamuna type of alluvium derived from the Himalayan source is also present in the Chautang but it is present at the base of deposits of geological sequence. The Protohistoric sites are found here in the upper geological deposits separates them by more than 7 m thick deposit from the Yamuna type alluvium. This intervening deposit is ascribed to an irregular and lowered alluvium activity related to the Shiwaliks and increased aeolian activity related to the Thar desert resulting into thin alternate deposition of alluvial and aeolian sands. Thus on the basis of sediment deposits Courty has successfully demonstrated the non-

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[126] Mughal 1992 The Consequences of River Changes for the Harappan Settlements in Cholistan. *The Eastern Anthropologist*, 45 (1-2):105-16

[127] S.P. Gupta 1996 *The Indus-Saraswati Civilization: Origin, Problems and Issues*, Pratibha Prakashan, Delhi

[128] V. N. Misra 1984 Climate, a Factor in the Rise and Fall of the Indus Civilization- Evidence from Rajasthan and Beyond in *Frontiers of the Indus Civilization*, Books & Books, New Delhi, pp- 461-488

[129] M.N.K. Puri

[130] Kalyanraman (Ed.) 1999, *Vedic Sarasvati*, Memoir Geological Society of India, No.42, pp.163-174.

[131] K.S. Valdia2002, *Saraswati- The River that Disappeared*, Universities Press, Hydrabad

[132] Fracfort 1986, Prelimenary Report (1983-1984): archaeological and environmental researches in the Ghaggar (Sarasvati) plains. Man and Environment, 10:97-100

[133] Suraj Bhan 1975 Excavations at Mitathal (1968) and other Explorations in the Sutlej-Yamuna Divide, Kurukshetra, Kurukshetra University.

[134] Marie-Agnes Courty 1989, Integration of sediments and Soil Information in the Reconstruction of protohistoric and Historical landscapes of the Ghaggar Plain (Northwest India), *South Asian Archaeology*, p. 255.

contemporarity of the protohistoric populations with Himalayan rivers. The rivers connected with Himalayan glaciers were active in the past in the Ghaggar plain but the depth of alluvium suggest that they are some ten thousands year older than the Protohistoric period.

b. Tectonic Activity

Tectonic activity has played a vital role in the Chutang because of the proximity of the junction of two major plates of the earthen crust, peninsular India and the main landmass of Asia. The thrashing of these against each other have caused the folding and up lifting of the mountains of Baluchistan, Himalayan, Karakom and other ranges, and the Tibetan plateau. This phenomenon has caused earthquakes, landslides, changes in the course of major rivers and other catastrophic events. It also tends to accelerate the processes of corrosion and aggravation basic to soil formation and affecting many other aspects of the natural resources of the region.

Hydrological studies conducted in recent years shows that the water of Saraswati got completely diverted into the Yamuna because of the tilt in the land mass in the sub-Himalayan region which occurred possibly due to earthquake. Thus, the probable reason for changing river courses is associated with earthquakes, some on larger scale may had serious consequences for settlements in the plains. This fact is also evident in the excavations at Kalibangan, excavator noticed faulted strata, as well faulted mud brick walls of Early Harappan period, resulting from an earthquake.[135] This destroyed the houses, and forced inhabitants to leave the site around 2700 B.C. Even today, the whole region is in earthquake zone.

c. Rainfall Pattern

The review of existing data suggests that while dealing with problem of factors affecting Protohistoric human habitation in Indus-Yamuna divide, archaeologist have laid more emphasis on the hydrological changes of the region as compared to other important factors like rainfall pattern and soil profile.

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[135] B.B. Lal 1998, India 1947-1997: *New Light on the Indus Civilization*, Aryan Books, New Delhi: 63-7.

Aurel Stein, John Marshall[136] and Mortimer Wheeler[137], scholars who laid foundations of the Harappan archaeology, also paid due attention to the role of environment during the Harappan period. They postulated that Harappans experienced wet climate as compared to the present semi-arid/ arid conditions. Their approach was cultural-historical as it was based on the material remains found in the excavated Harappan settlements. This theory remained accepted till later on scholars came up with alternative theories of hydrological changes responsible for the destruction of the Harappan Civilization discussed earlier.

Gurdeep Singh revived the theory of 'wet climate' earlier proposed by Marshall Wheeler. In contrast to these scholars his propositions were based on the palynological data from the lakes in Rajasthan- Sambar, Didwana, Lunkaransar and Pushakar rather than archaeological evidence. [138] He reviewed climatic changes with several fluctuations of entire Holocene period in north-west India and demonstrated that how these climatic fluctuations were related to the origin of agriculture, growth and decline of the Harappan civilization. The rise in rainfall around 8000 B.C. in Rajasthan was responsible for the emergence of cereal agriculture in north-west India around 7500 B.C. An exception rainfall around 3000 B.C. accelerated the expansion of farm bases settlements in the region and also caused the prosperity of the Harappan culture. A decrease in rainfall around 1800 B.C. led to decline of the Harappan culture. The aridity between 2000 B.C. and 1000 B.C. was responsible for the cultural gap between the Harappan and Painted Grey Ware cultures. This theory is further supported in modified form by many scientists-Enzel[139], Kajale[140] and Saraswat.[141] Bridget Allchin

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[136] John Marshall 1931*Mohenjo- daro and the Indus Civilization*, Arthur Probsthain, London

[137] Mortimer Wheeler 1968 The Indus Civilization, Supplementary Volume to the Cambridge Ancient History of India. Cambridge.

[138] Gurudip Singh 1977 Climate Changes in the Indian Desert, Desertification and its Control. New Delhi: Indian Council of Agricultural Research:25-30.

[139] Y.Enzel , Ely, S. Mishra, R. Ramesh, R. Amit, B. Lazar, S. N. Rajaguru, V. R. Baker and A. Sandler, 1999, High-Resolution Holocene Environmental Changes in the Thar Desert, Northwestern India, *Science*, Vol. 284. no. 5411, pp. 125 – 128.

[140] M.D. Kajale, Deotare, B.C., and Rajaguru, S.N. 2004, Palaeomonsoons and Palaeoclimatic Background to the Prehistoric Cultures of the Western and Central Thar desert, Rajasthan, Northwestern India, *Mansoon and Civilization*, Roli Books, New Delhi, pp. 83-98.

[141] K.S. Saraswat and Pokharia A.K. 2003, Palaeobotanical Investigations at Early Harappan Kunal, *Pragdhara*,No.13: 105-139.

does not reject Sing's theory of 'wet climate' completely. [142] According to her even a slight amelioration of arid conditions would have increased the availability of surface water, game and pasture for domestic animals and probably made possible dry (i.e. non irrigable) cultivation of cereal crop, other food plants and cotton on parts of the plain nor subject to inundation.

Dhavalikar analysed monsoon in antiquity and its impact on the human culture on the basis of work of Sir Gilbert Walker who studied rainfall data from India and Africa from 1840 to 1910 and discovered the close correspondence between the abundance of Nile floods and the monsoon rains in the northwest and eastern India.[143] The years of draught in north-western India are almost invariably the years of low Nile flood. The year of heavier rainfall in western India is the year of high Nile flood. This data is available right from 2900 B.C. to 1521 A.D and survives in form of flood level marks, inscriptions, marks on buildings, temples and steps leading to the river. Dhavalikar finds the Nile flood data extremely reliable as it appears that there was drastic change in climate from the beginning of the second millennium B.C. and the same is supported by the evidence of Nile levels. The Nile flood data reveal that during the forth and the third millennia the climate was favourable with good rainfall. It seems that level was quite low in 2850+ 100 B.C. and again in 1950 +50 B.C. Consequently there were severe famines in Egypt. The urban culture in Iran collapsed around 2100 B.C. as in Central Asia. Increasing aridity was the main cause of the collapse of early civilizations.

Preliminary studies of microflora carried out at Kunal indicate that that the area around was once covered with mesophytic seemingly belonging to various families of flowering plants Ranuculaceae, Crucifere, Polygonacea, Nympheacaceae, Amranthaceae, Compositae, Batulaceae, Mimosidel, Labiate, etc. The fauna and flora suggests that the atmosphere was surcharged with excessive humidity. The climatic conditions do not tally with the present semi-desertic climate of the region. The climate of the

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[142] Bridget Allchin 1982 *The Rise of Civilization in India and Pakistan*. Cambridge University Press, Cambridge.

143 M.K. Dhavalikar 2003, Green Imperialism: Monsoon in Antiquity and Human Response, *Archaeology of Western India*, B.J. Institute, Ahmedabad, pp-128-57.

region has witnessed a sharp shift from warm humid to semi-arid nature. The clay sample collected was from the top levels of the site.[144]

Dune pattern also shows that the paleaowind direction was essentially towards north east and continues to be almost the same day today. Such strong palaeowind directed sand flow would have obstructed the southwesterly flow of Saraswati and caused it to migrate northwest.

d. Human Activity

Any settlement or regularly inhabited place also has some widened influence upon its environment; the most obvious and immediate effect of any human settlement, large or small upon its environment is signs of wear on the surrounding soil and vegetation. Grazing herds of domestic animals, often not indigenous to an area can modify the natural vegetation considerably; so selective killing or driving out of certain wild species because they are desirable for food, complete with domestic animals or pray upon them. The cutting of trees, bushes etc. for timber, firewood and fodder for animal has even more direct impact. The modification in flora must have affected the animal population. As the result, there must have been deduction in the number of wild animals as well they were driven away from the settlements. The population from this region spilled over into Upper Sutluj in Punjab and Uttar Pradesh as is seen by the dramatic increase in Late Harappan settlement in those areas.

Summation

The review of the existing literature on the Harappan environment, suggests that the most important question was whether large rivers were active during the Protohistoric period? Or to be more precise, the Ghaggar and its subsidiary rivers were connected to Himalayan glaciers or whether they were rain fed? Though, subject matter has been discussed in great length by scholars (Oldham, 1874, Oldham, 1886, Raikes 1968, Yash Pal 1984, Misra 1984 and 1991, Puri 1998, Valdiya 2002) to suggest perennial,

[144] Sharma S. K. 1995 Scientific Studies of Kunal Site, Disstt. Hissar, Haryana, *Puratattva*, No.25, New Delhi, p.87.

glacier-fed status of the Ghaggar and Chautang rivers in Protohistoric period, existing data on rainfall and soil types indicate a different story.

The studies carried out on rainfall pattern of north-western India (Singh 1971 and 1974, Enzel 1999, Kajale 2002, Shinde 2002) and comparison of the Nile flood data with Indian rainfall (Dhavalikar 2002 and 2003) clearly show fluctuations in rainfall pattern throughout the Holocene period. Though growth and decline of the Harappan Civilization certainly did not solely depended on rainfall, it appear to have been one of the important factors for the population based on the agrarian economy.

Studies on sediments carried out by Indo-French Mission during 1984-86 in Ghaggar region demonstrate that sediments of Himalayan origin are deep buried in the geological sections of the Ghaggar and Chautang. The contemporary geological deposits to Protohistoric archaeological sites are alternative layers of alluvium of Siwalik origin and aeolian sand indicating short wet and dry phases (Courty 1986 and 1989). In course of discussion of the following chapters, after co-relating environmental and archaeological data a clearer picture will emerge to explain cultural change in the Protohistoric Chautang basin.

As suggested by location analysis, it is clear that the drying up of Drishadwati was the major factor responsible for environment and cultural changes occurred in the region around Rakhigarhi. It is a huge settlement of 124 Hectors, only next to Mohenjodaro in whole Harappan domain, must have sustained enormous population. Besides this major settlement there are almost 21 small satellite settlements in the catchment area of Rakhigarhi. This pressure of population may have exhausted the environment and resources in the surrounding area. The farming and grazing activities probably led to vegetation degradation and soil erosion. Today natural vegetation around these ancient settlements has been reduced to relict stands by deforestation resulting from sheep and goat grazing, tree cutting and extensive cultivation. The studies carried out by Ahuja and Sing (1983) also indicate that the ancient flood plains of Drishadwati are affected by salt action. These saline soils causes problem of impeded drainage, high salt toxicity to plant growth, water logging leads to

poor fertility status. Besides agriculture, ground water which was used for drinking turned brackish as recharge cycle was disturbed forcing population to move out. Today with some modern soil management practices better fertility could be achieved. But during the Harappan times soil profile must have been better with fresh annual inundation, for traditional agriculture. This factor must have been helpful for the growth of vegetation, which consisted more verity of flora and supported wide range of fauna also.

Thus, the environment around Rakhigarhi was not tropical as it was thought by Marshall and Piggot for Mohenjodaro and it was not also completely arid. It would have been slightly more humid than today, with more vegetation. The Harappan Rahkigarhi had semi- arid climate with better kind of soil profile, flora and fauna with sufficient source of water in form of ancient Drishadwati.

Chapter 3

Site Catchment Analysis

Introduction

Rakhigarhi is one of the five largest archaeological sites of the Harappan Civilization categorised as a metropolitan centre. The aim of present paper is to determine function of Rakhigarhi and its satellite sites spread around by applying the method of site catchment analysis. This incorporates the study of exploitation of resources by the ancient inhabitants right from the pre-formative stage down to the mature Harappan stage. It further explains long distance and inter-site networks in procurement and supply of commodities. The hierarchical position of Rakhigarhi in the settlement pattern of Sarasvati and Drishadvati valley has also been discussed.

Higgs and Vita-Finzi (1970) are the pioneers in the application of site catchment analysis in archaeological context. They have devised a mechanism for the study of area around the site that would have been exploited by the inhabitants. Such studies may as well be termed as analysis of site exploitation territory whereby proportions of exploitation of resources within a given territory of arable and pastoral land are calculated to assess the nature and function of the site. Literally, the catchment denotes the area from which rainfall flows into a river, lake or basin. In archaeological context it is applied to an area from where resources are exploited by the occupants of an ancient site for sustenance. The basic assumption in site catchment analysis lies on the parameter of site location vis-à-vis resources and energy input depending on the to-and-fro distance between habitation and resource area. In Indian context, site catchment analysis has been successfully applied sparingly at individual sites like Inamgoan (Pappu 1988), Kuntasi (Pappu 1996) and Balathal (DasGupta 2006), while in Tapi (Tapti) basin (Pappu and Shinde 1990) in regional context. Taking clue from these studies, an attempt has been made to understand the resource management pattern

in the Harappan context at Rakhigarhi (29^{0}17’30" N and 76^{0}06’50" E) located in the Sarasvati-Drishadvati divide.

Tradition enumerates that the land was watered by a set of seven streams (*Saptasvasa*) and camouflaged by seven forests. Among the rivers Sarasvati and Drishadvati of Rigvedic fame are eulogized most. The *Rigveda* cites the flow of Sarasvati from the hills to the sea (*RV*, VIII. 95.2) and existence of a series of settlements on its banks (*RV*, VIII. 96.2). Further it is also noted that the Drishadvati and Apaya are her tributaries (*RV,* 3.23.4). Sarasvati as of now is known as Sarsuti while Drishadvati identified with the Rakshi (Cunningham 1882: 88) gets strengthened with the merger of the Kausiki near Balu, a Harappan site (Singh and Bhan 1982). Their joint flow known as Chautang traverses across the south west of central Haryana, ultimately merges with the Sarasvati near Suratgarh. Besides Drishadvati, other streams traditionally served as tributaries (S*aptasvasa*) to the system could have been known as Vaitarani, Apaga or Apaya, Mandakini, Madhusrva, Ansumati and Hiranyavati. As of now it is difficult to identify each one of them as their drainage pattern got interwoven and inosculated with each other to water the canals dug at the behest of Firoz Shah Tughlaq. The *Tarikh-i-Ferozshahi* (Afify 1891) infers resolving of scarcity of water in the neighbourhood of Hisar Firozah founded by Sultan Firoz by reviving two streams, one from the *Jumna* known as *Rajiwah* and the other from the *Sutlej* known as *Alagh-khani*. *Rajiwah* said to have traversed through the vicinity of Karnal to reach Hisar Firozah (Hissar). The *Ain-i-Akbari* supplements above data (Jarrett 1891:278-293). It was a profitable effort of water management of the medieval period at the cost of loosing existence of traditionally known tributaries of the Sarasvati-Drishadvati rivers.

Attempts have been made to trace these channels originating from the Sub-Himalayan region. The channel of Rakshi has been identified with the Drishadvati (Cunningham 1882:88, Bal Bhadra 1976: 37). Thereby it may be construed that the toponym of Rakhi (*Rakshi*) garhi seems to have been derived after the topographical feature of the place located in the flood bed of the Rakshi river*. There are eponymous examples where settlements have

been named after rivers like Ganga Sagar (Ganga), Varanasi (Varuna and Assi), Yamuna Nagar (Yamuna), Jammu (Jammu Tavi), Wardha (Wardha), East and West Godavari Districts (Godavari) Kaveri Pattanam (Kaveri).

The upper reaches of water bodies of study area are rich in mineral, metal and forest resources. Plenty of rolled blocks and cobblestones collected from their beds are useful material for construction as well as preparation of sling balls for games and mortar as food processing equipment, and implements like potter's dabber, polisher, whetstone, anvil etc. Drishadvati is also known as Patharali, both convey the meaning of ample of stones or rocky bed. As of now, bed of the river preserves this character (Bal Bhadra 1976: 37).

The study area

The site at Rakhigarhi was subjected to excavation during the year 1997-98 (Nath 1998), 1998-99 (Nath 1999) and 1999-2000 (Nath 2001). The archaeological mounds are closely integrated and they have been numbered as RGR 1, RGR 2, RGR 3, RGR 4, RGR 5, RGR 6 and RGR 7. Out of these habitation mounds, RGR 1, RGR 2 and RGR 6 have revealed occupation of pre-formative stage followed by the early Harappan settlement whereas RGR 7 is a necropolis. The radiometric dates obtained from RGR 1, RGR 2 and RGR 6 are tabulated below:

Period	S. No.	BSIP Ref.	Ref. No.	Radiocarbon age (Yrs BP)	Calibrated Age (Yrs BP)	Sample CO2
Pre-formative	S – 4173	BS – 3318	No. 58, RGR – 6, 4.96 m	5640 ± 110	6420 ± 110	96.3
Pre-formative	S - 4187	BS – 3341	No. 51, RGR - 6, 4. 23 m	5440 ± 290	6230 ± 320	18.3
Early Harappan	S – 4190	BS – 3344	No. 46, RGR - 1	4570 ± 100	5230 ± 60	39.4
Early Harappan	S – 4180	BS – 3324	No. 213, RGR - 2, 8.45 m	5200 ± 100	5910 ±130	98.5
Mature Harappan	S – 4215	BS – 3368	No. 78, RGR - 2, 6.40 m	4040 ± 90	4560 ± 90	44.8
Mature Harappan	S – 4237	BS – 3389	No. 187, RGR - 2, 5.60 – 5.90 m	3900 ± 110	4320 ± 90	33.0

Table 1: Radiometric dates from Rakhigarhi

As regards the antecedents of the early Harappans in the Sarasvati-Drishadvati Divide a trend has been noticed to identify the horizon as Hakra ware culture (Lal *et al.* 2003, Rao 2006). As we know, the downstream of joint flow of Sarasvati-Drishadvati River is known as Hakra in the Cholistan desert besides Nara and Wahind. It may not be out of place to record that the Hakra ware culture horizon noted in the Cholistan desert is purely based on explored data (Mughal 1997). These explored data are incidentally reminiscent to the excavated material from Sothi (Dikshit 1984). Therefore there should be a strong plea for a change in the nomenclature from Hakra ware culture to Sothi phase as the horizon of antecedents of the Early Harappans in the Sarasvati-Drishadvati Divide has been noticed in the explored (Ghosh 1952) and excavated context (Dikshit 1984) first at Sothi, being the type site. Therefore the pre-formative stage noticed at Rakhigarhi below the Early Harappan horizon may be nomenclatured as Sothi phase on similar lines as Ravi phase at Harappa (Kenoyer 2011). Rakhigarhi is one of the largest sites located in the eastern domain of Harappan empire and may reasonably be identified as their 'Provincial Capital' of the eastern domain. The site falls under the dense settlement zone sustained by surplus agricultural produce, forest, mineral and metal resources. The limited excavation has given rich dividends for an in-depth study of site catchment analysis.

Methodology

Study of resource management to understand the volume of exploitation for sustenance at Rakhigarhi located in the traditionally vibrant land of the Sarasvati-Drishadvati would identify the forces which stimulated gradual changes within a set process from the pre-formative occupation to the early and mature Harappan stages.

The basic aim of present study is to determine function of the Harappan Rakhigarhi and its contemporary satellite sites spread around by applying the method of site catchment analysis. This is also an attempt to analyse exploitation of resources by the ancient community by zone-wise distribution of resources. The hierarchical position of Rakhigarhi in the settlement pattern system has been discussed in detail. The scope of the present case study involves analysis of factors like climate, landform, drainage, flora, fauna and soil and to locate the provenance of raw material. The present day environmental conditions may not be applicable to those of Harappan era; hence environmental changes have also been taken into consideration.

Extensive explorations have been carried out in and around Rakhigarhi to get three-fold data by (i) locating the satellite settlements spread around the site in the palaeo-channels of Drishadvati and its tributaries, (ii) defining different catchment areas by studying the landforms and reliefs, flora, fauna, soil types, agriculture, modern land use pattern, mineral resources and drainage system and (iii) exploring the modern economic activities to draw ethnographic parallels for defining past patterns of human behaviour.

To facilitate the study, the area around the site has been divided into three concentric circles at regular intervals of 5, 10 and 15 km. The field data generated through foot surveys, analysis of maps and published data have been plotted within the framework of the hypothetical concentric circles which have provided meaningful result to the three-fold objectives noted above.

Environment

The study area lies in the flood plains of Sarasvati-Drishadvati basin. In the past, Drishadvati flowed through the modern districts of Karnal, Jind and Hissar before meeting Sarasvati near Suratgarh in Rajasthan. The study

of environs is based on published reports (Ahuja and Singh 1983) as well as field observations. Ahuja and Singh have adopted a technique of systematic aerial photo interpretation in correspondence with a sound field check. Several borings were taken in each of the physiographic units which were demarcated by using aerial photographs with interpretation lines as the base map and then the soils were fully described. Based on the field data and physio-chemical analysis in laboratory different soil series were established.

Topographically, this area is flat, monotonous upland plain. On broader perspective it is part of the alluvial of Satluj-Yamuna plain, western portion of which marks gradual transition to the Thar Desert. Dominant feature of topography is occurrence of aeolian sand of variable shape and thickness overlying the Pleistocene alluvium. These patches of older alluvium are either exposed or occur at shallow depth beneath a veneer of sand in *tals* or topographic depressions enclosed by fixed dunes. These plains mainly consist of sand dunes and sand hills known as *tibbas*. General gradient of the terrain is from north-east to south-west and then west. In comparison to the plains, the filled up channels occupy relatively lower position, with continuous or intermittent levee undulations. These channels primarily contain the flood plain sediments.

Hard rock geology of this area is concealed under alluvial and aeolian deposits. The alluvial deposits of quaternary age are divisible into newer and older. The former occurs in active flood plain of the Sarasvati (Ghaggar) river, which flows in the north of the study area while Drishadvati (Chautang) to the south is filled with riverine sediments comprising of clay mixed with sand, silt and occasional Plate Randle gravel. Calcareous concentration in various proportions is found mixed with other constituents. The sediments are heterogeneous in character and are deposited on a basement of metamorphic and igneous rock of pre-Cambrian age. The geomorphic processes that have been acting upon this region are (i) organic: uplift of the Himalayas resulting into trough or sag, (ii) fluvio-glacial: after Pleistocene glaciations and subsequent melting of glaciers resulted in river channels, (iii)

fluviatile (pluvial) : during high rainfall, a number of rivers flowing, braided drainage and deposition, filling up of the trough, (iv) fluvial: major stream network developed on more or less levelled alluvial plain and (v) fluvio-aeolin: glacier feeding cut off at the source of the streams and choking of the river north with aeolian deposit (Ahuja 1983: 6-7).

The foot surveyed area falls to the south of Sarasvati (Ghaggar) localised between the old relics of Drishadvati (Chautang) which flow in the upper and lower part of the present study area, now recognised as the Hansi branch of the Western Yamuna Canal. The river drains large column of flood flow during the rainy season mostly between July to September and it generally remains dry in summer. However, inflow of the ground water remains active as late as October. This water source stimulated the early colonisers to occupy this fertile terrain. At present, there is no perennial or seasonal stream flowing through the confines of study area. In the absence of major or minor rivers, canal irrigation has become the main solution for modern day agriculture. For domestic purpose, people mostly depend upon tube wells and palaeo-lakes and tanks. The depth of water table generally ranges from 0.83 to 39.80 m. The subsoil water of this area is overall brackish due to the over use of chemicals and fertilizers for high yields. The quality of the water varies from place to place and from well to well. The sweet water is found from wells located in areas having ameliorating factors like existing or old stream courses, long standing irrigation seepage from *kachcha* tanks. Currently, there are chains of irrigation canals built in the depressions of palaeo-channels of old system. The practice had already started during the time of Firoz Shah Tughlaq.

The area experiences a subtropical, continental secondary, monsoonal type of climate with prolonged hot period from March to October and fairly cool winters. The extreme temperature and scanty rainfall characterizes the climate of the study area. The maximum temperature during the summer season ranges between 45^0 - 48^0 C. January is generally the coldest month; temperature varies from 21^0 - 7^0 C. An average soil temperature of 16^0 to 21^0 C exists during the winter season which is quite favourable for cultivation of crops like *guara*, *raya*, sesame, wheat, barley, peas etc.

The velocity of winds as noted is generally less blowing with an average speed of 7 km per hour. Monthly mean wind spin ranges from 4 to 10 km per hour. Occasionally westerly wind velocities of more than 50 to 60 km per hour have been observed in the months of May and June. This creates an extreme moister deficiency and soil erosion in the region. During the winter season north-westerly cold winds of 10-20 km per hour have been recorded occasionally. In the post monsoon and winter season, south-westerly or westerly winds are more common in the mornings whereas northerly and north-westerly are predominant in the afternoon. In the summer, winds are more common from the west or southwest in the morning. In the afternoons, they are mostly from directions between west and northwest.

The occurrence of respective pattern of physiographic units is evident in each of the climatic sub-divisions. The soil distribution is closely related to the landforms. In Haryana a satisfactory landscape soil relation has been established by using the technique of aerial photo interpretation and landsat imageries. Such relationships have been worked out by many experts out of which the works of Ahuja and Singh (1979) are taken as the base for the present study.

The catchment area of Rakhigarhi consists of only two physiographic units: (i) Upper Alluvial plain and (ii) Drishadvati Flood plain. The soil series (Fig.1) around Rakhigarhi are described as under:

The soils under *Behel* series has yellowish brown sandy upper horizons with higher evapo-transpiration and brown to dark yellowish brown, non-saline, non-sodic, non-sticky, non-plastic in lower horizons. These are partially stabilized to un-stabilized, severely eroded, excessively drained sand dunes of aeolian nature. Hence these soils have been placed under aridic moister regime. At present gram and *bajara* is marginally cultivated and growth of grasses like *dab* and *doob*, scrubs like *jand* and *jal* are also witnessed.

The soils of *Rawalwas* series are loamy sand, consisting of alluvium covered with aeolian cover. These soils are slightly eroded, well drained with moderate infiltration. Occasionally *Bajara* and gram cultivation is possible during years of favourable rainfall. Grasses like *doob* and *Jal* and *Kikar* trees grow naturally on these soils.

Ninanda series soils have pale brown (dry) and brown (moist) loamy sand in upper horizons, brown to dark brown non-saline, non-sodic, sandy loam, weakly developed and moderately calcareous in the lower horizons. This type of soil is generally alluvium covered with aeolian sand and normally well drained with moderate infiltration rate. They are slightly eroded and presently levelled, irrigated and cultivated with occasional cultivation of cotton, whereas *kikar* and *jal* grow naturally here.

Jallopur series have yellowish brown, sandy loam in upper horizons, sandy loam to moderately developed loam over flood coatings of alluvium and it is non-calcarious, non-saline in the lower horizons. These are well drained soils of moderate permeability with negligible erosion. These are well irrigated soils at present and cultivation of wheat, gram, and mustard is seen along with raising of *neem* and *kikar* trees.

Soils under *Shamri* series on surface bear white incrustations of salts, brown colour and loamy sand texture. The lower horizons are brown to yellowish brown in colour and sandy loam to loam in texture, moderately to strongly saline, moderately saline and non-calcareous in nature. They occur

on plain salt affected lands, high in water table for most of the period causing capillary rise and salt incrustations on surface. These soils are slightly eroded, salt affected Drishadvati alluvium plain with impeded drainage and low infiltration. They are categorised as waste land with Luni or Bui (*suaedafructicose)* weed.

Soils under *Kaithal* series are dominated by aeolian sands with high infiltration rate and not so preferred for cultivation, occasional grasses are noticed.

Environmental changes

There are epitomes on the palaeo-environmental changes leading to ecological imbalances and dispersals of population from the Sarasvati-Drishadvati Divide. Reliefs of their palaeo-channels are still being tracked down in parts of Haryana and northern Rajasthan (Bhargava 1964:52-101). Studies have revealed that the Sarasvati (Ghaggar) originating from the Himalayan glaciers, flowed to the sea (Bisht 2002) corroborating Vedic inference (*RV, VII.95.2).* At some point of time, it was also fed by the Satluj. Likewise it is also considered that Drishadvati originating from the Himalayan region was nurtured by a channel of the Yamuna. Due to certain tectonic disturbances, the channels of the Satluj and Yamuna stopped feeding Sarasvati and Drishadvati respectively around 1900 BCE (Misra 1984). A critical analysis of the studies carried out by the scientists in the study area on the environmental issues using different inputs and methods have resulted in the divergent perceptions (Danino 2008). The hydrographical changes in the Sarasvati-Drishadvati system led to the weakening of the social fabric (Chakrabarti 1997: 140) followed by dispersal of population. There are certain studies which demonstrate fluctuations in rainfall pattern throughout the Holocene period (Dhavalikar 2003) with certain amount of consistency during the rise and maturity of the Harappan civilization (Shinde *et al.* 2004:387-388).

The existing complexities in the soil morphology have impacted the colonisation in the Sarasvati-Drishadvati Divide. Studies on sediments carried out by the Indo-French Mission during 1984-86 in this valley has revealed sediments of the Himalayan origin which are buried deep in the geological strata of the Ghaggar and Chautang. The contemporary geological deposits indicate alternative layers of alluvium of Siwalik origin and aeolian sand resulted due to short wet and dry phases (Courty 1986 and 1989) indicating cycles of rainfall. In this deposit are embedded archaeological sites experiencing cultural changes.

The suitability of soil for agriculture was the prime concern of the first colonisers in the study area. A macro-environmental survey of the region around Rakhigarhi indicates that most ancient mounds were situated on the edge of the Chautang river flood zone. The occupants first gave the preference to the *class one* type of cultivable lands which are located within the extent of flood zone. There are several sites which are located in moderately cultivable soils and few of them are located in a relatively poor soil quality segment. The existing pattern of the soil types is an important factor affecting distribution of the protohistoric settlements in the Chautang basin. A clear preference seems to have been given to good quality cultivable lands; other types were also utilized for other economic activities like pasture lands or industrial settlements (Garge 2006: 43-9).

Satellite settlements around Rakhigarhi

Recent explorations carried out in the Sarasvati-Drishadvati divide (Kumar 2009) have revealed cluster of settlements of the protohistoric period which indicate extensive harnessing of the riparian plain by canalising water sources. The sites explored in this divide number 558 (Pre-formative and Early Harappan), 114 (Mature Harappan) and 1168 (Late Harappan) (Danino 2010:139-41). The relics of settlement have been found dotted along the abundant canals and streams bears a testimony to the knowledge of water harvesting and irrigation of agricultural fields in the Sarasvati-Drishadvati divide. As per the tradition, the mighty river Sarasvati had an average 8 km

wide bed which was braided into a multitude of channels. This was possibly caused due to enechelon faults; it was prone to drastic changes caused even by minor tectonic movements (Agrawal and Sood 1982: 226). Because of such natural phenomenon the occupants must have thought of managing hydrological sources by cutting across canals between the two streams as well as devising storage of water in big ponds i.e. *Puskarni* (*RV,* X.107.10) or *Puskara* (*RV,*VIII.61.11). An epigraph of 10th century CE from Pehoa cites about an eastern branch of the Sarasvati (*Prachi Sarasvati*) while a text contemporary to the said epigraph apprises that there was an effective canal irrigation network (Chakrabarti and Saini 2009:36-37) in this area. Similar observation has been made earlier (Bisht 1993:114) corroborating above noted inscriptional and literary data of circa 10th century CE.

Possibility of clearance of forest and reclamation of land to meet the growing need of agriculture (*RV*, X.28.8) gets attested (Singh 1997). The site of Rakhigarhi lies between two runnels forming a peninsular setting interspaced with green pasture land and gallery forest. The inhabitants applied their acumen and took advantage out of prevailing favourable ecological niches for their sustenance and cultural advancement.

As per the requirement of catchment analysis, the area around Rakhigarhi has imaginarily been sub-divided into 3 concentric circles ranging 5, 10 and 15 km radius (Fig. 2) for the convenience of documentation of the site. As per the initial foot survey, 23 satellite locations have been identified for the study. Subsequently a set of sites have come to light from Masudpur (Masaudpur) which lies south-west of Rakhigarhi (Patrie *et al.* 2009: 41) falling between 10 to 15 km radius.

i. Sites within the area of 5 km radius: Gamra, Budana, Haibatpur, Lohari Ragho 3

ii. Sites between the area of 5 to 10 km radius: Lohari Ragho 1, Lohari Ragho 2, Kheri Lochab-Jalab, Milakpur, Kinar, Sotha, Gandaswala Khera, Nara, Mirchpur, Gunkali

iii. Sites between the area of 10 to 15 km radius: Panhari, Gyanpura, Sotha, Kagsar, Sulchani, Sisai, Rajpura-2, Pali, Masudpur.

These satellite settlements of consequence are quite important as they played a crucial role in buttressing Rakhigarhi to the status of a metropolis. After obtaining urban status with dense concentration of population, de-urbanization took place due to environmental changes, diffusion and migration of population is evident. This phenomenon is well demonstrated in the area of 15 km radius.

Discussion

The vast alluvial land combined with a network of hydrological sources was a crucial ergonomic factor for settlements in the Sarasvati-Drishadvati valley to flourish rapidly. Approach of site catchment analysis at Rakhigarhi is based on the distribution of arable land around the ancient settlement besides water ways. Modern land use categories and in particular soils are taken as parameters for the reconstruction of prehistoric land use pattern. To correlate this factor with the Harappan cultural scenario, the satellite sites have been plotted on a soil map. The landscape during the first occupation at Rakhigarhi was more or less akin to the present one and soil conditions in general were relatively better, due to presence of river and more vegetation cover.

Initially the occupants thrived on agro-pastoral subsistence pattern. In general the process of agriculture is a craft which involves specialised knowledge of a variety of technologies in an unstable hydraulic system combined with inclement weather condition. Farming is a tedious venture which, at times, hardly commensurate with the expenditure incurred on the

work force and the quantum of produce. It requires innovative tools and skills, knowledge of crop pattern, selection of grains for seeds for sowing, enriching soil by manure, reaping, thrashing, grinding, and pounding besides suitable storage and preservation of grains from insects and ultimately development of food processing equipments. Seasonal failure of crop due to inclement weather and shifting of hydraulic system consequently frustrated some farmers of repute to opt for trade as mode of alternative subsistence.

The excavations have strengthened the above argument. The existence of *foreign* material at Rakhigarhi shows that the site was participating in long distance trade or exchange system. Excavations have also shown evidence of highly specialised craft production for inter-site and long distance trade as well as manufacturing of items for local consumption.

Within the settlement

A glance at the modern land use pattern around Rakhigarhi has shown availability of number of resources required for the basic subsistence activity for the settlement. The alluvial land in close vicinity of the ancient site is categorised as the class I fertile land. There are traditional inferences to fertile (*Urjasvati*) and irrigated (*Payasvati*) high-yielding (*Susuma*) land (Singh 1997). Such inferences apply well to the surroundings of Rakhigarhi. The soil is sandy loam, serves as source of clay for pottery making, terracotta objects and house building material. *Kikar* (*Acacia arabica*) and *Neem* (*Azadiracta indica*) are quite useful trees for domestic activities. The present day water works reminds dependence on canal irrigation. There are number of palaeo ponds within the periphery and in the vicinity of the site indicating old relics of palaeo-channels.

From the settlement to 5 km radius

As per the parameter normally followed in the catchment study, the nature of exploitation for subsistence in the first 5 km radius has been worked out. The perimeter of this exploitation territory covers an area of 78-57 sq km i.e. 7857 hectares. The arable land within this radius is 78%, i.e. 6128.46 hectors.

The area around the ancient settlement consists of alluvium covered by aeolian indicating a profile of sandy loam. Obviously the landform was exploited for extensive agriculture with the support of canal irrigation. The agricultural waste and vast grazing ground around the site must have given rise to animal husbandry. The excavations have reported from the pre-formative stage i.e. below the Early Harappan (Formative) horizon found remains of domesticated cattle, zebu, buffalo, goat, sheep and pig. The enormous faunal data accessed at the site echo man-animal inter dependence as well as their food habits. Cattle bones have outnumbered over other animal bones, including that of the wild variety. High percentage of cattle and other domesticated varieties of animal bones is indicator of availability of wide spread pastoral land for grazing as well as husbandry there of as important means of subsistence for a set of people. Ethno archaeological study at the site reveals that the villagers prefer to breed buffalo to draw ample milk over cow, goat and sheep. Conspicuously the excavations at the site have reported high percentage of buffalo bones from various occupation levels; it is therefore believed, that occupants of that era relied on dairy products which might have led to an incipient stage of 'white revolution' of the postmodern era.

Archaeobotanical remains from the Divide have reported two crop patterns postulated on the basis of finds evidenced at sites like Kunal (Acharya 2008), Balu (*IAR* 1996-97), Bhirrana (Rao *et al.* 2004-5: 66), Kalibangan (Lal *et al.* 2003). The winter or *rabi* crops are barley, wheat, peas, lentils, chick-pea etc., while summer or *kharif* ones are rice, millets, dates, gram, cotton etc. There are pieces of wattle-and-daub from the lower levels at Rakhigarhi embedded with rice husks which are currently under

examination by Dr. K.S. Saraswat. Apparently the natural ground setting around these elevated settlements witnessed a phenomenal combination of agriculture and pasture land interwoven with seasonal subsidiary channels together with a network of irrigation channel as the kind of crops grown required regular irrigation facility. The kind of archaeobotanical potential generated from this region hint at moderate winter and summer rains contributing to periodical flooding of the cultivable plains of the region without which harvesting of crops of the two seasons could not be envisaged. In such multi-croping strategy canal irrigation remains advantageous in reaping high yields in a localised agro-ecological zone (Weber *et al.* 2010). The ethnographic study in this zone demonstrates the variability and high yields of agricultural produce.

The antecedents of these floral and faunal evidences may be traced back to the Neolithic origin in the neighbouring region of mid Ganga plain and Vindhyan region (Pal 2006). Equally significant data obtained from the Mesolithic sites located in the Aravallis (Shinde 2008), indicate that this region could also have influenced the floral and faunal acquisitions of the Sarasvati-Drishvadvati Divide.

Beside Rakhigarhi, four more ancient settlements existed within the arable land of 5 km radius which can be interpreted as agricultural settlements. Antiquity of Gamada goes back to the early Harappan period which coexisted with Haibatpur and Lohari Ragho 3. The settlement at Budana emerges during the mature Harappan stage. Since the early days of occupation, these small sized settlements initially emerged as farmsteads and subsequently turned into small villages to look after the interest of nodal site, i.e. Rakhigarhi in the surplus production of agriculture besides stock rearing.

From ethnographic parallels, it is clear that, farmers of Rakhigarhi cover an area of 4 to 5 km for farming activity. The towering village controls quite large agricultural land as compared to other villages of the neighbourhood. Barley and wheat were main crops taken by the Harappan

farmers of Rakhgarhi as this area falls into the category of winter receiving rainfall zone. First season of excavations at Rakhigarhi has established existence of wheat, barley in the mature Harappan period and seeds of *bathua* (*Chenopodium*) in the early Harappan period. The plants of *bathua* occur in wheat and barley fields (Saxena 1979) forming an important constituents of the human diet. Young shoots of this plant function as dyestuff for extracting green colour. Their seeds are useful in the preparation of starch for stiffening fabric. These seeds have been reported from the burnt brick bat floor of a courtyard which was used as dyeing vat (Nath 1999). Other corroborative data noted at the site are imprints of fabric over copper ornaments, a burnt patch of textile over a mud floor, besides an actual specimen sticking to a red ware vessel. Occurrence of equipments like spindle whorls from the early Harappan horizon and spool for winding thread from the mature Harappan level indicate a flourishing textile related vacationalism, besides ancillary engagements like winnowing, ginning, spinning, weaving etc. Evidence of cotton from a neighbouring site at Kunal (Acharya 2008:28) further strengthens above hypothesis.

Another early Harappan site at Haibatpur apparently exploited the pasture land which covers almost 12% of the total land of the area. The value of pastoral activity has been realised since the early Harappan times. Besides agriculture, the present day folk practice rearing of animals like buffalo, cow, sheep and goat, primarily to draw milk.

One more site recognised as Lohari Ragho 3 lies in a small patch of aeolian sand to the south-west of Rakhigarhi. The area comprises of sand with low clay content, hence suffers from excessive drainage, making it unsuitable for agriculture. The character of soils on which the site is situated indicates that they were not primarily agricultural in nature. Growth of grass like *dab* (*Sachrarum Spp*) and *doof* (*cyndondactylon*) suggest their pastoral orientation. Surface investigation at the site reveals concentration of white circular patches of ash (kilns) that are spaced at regular intervals and has average diameters of around 1 m. As many as 17 such kilns, which are associated with over-fired terracotta cakes and

cracked burnt bones, have been noticed in a compact area of 75 X 50 m. Another important finding is the presence of collumela of *Turbinellapyrum* indicating shell craft activity (Garge 2006). These data indicate industrial character of the site besides agro-pastoral connection. As per the site hierarchy procurement of raw materials was prerogative of the nodal site from where these items were distributed to the craft centres located in the neighbourhood. The finished products were generally brought to the nodal site for marketing.

From 5 to 10 km radius

The total area covered between 5 to 10 km radius is 314.3 sq. km. As compared to the 5 km radius, the percentage of arable land in this zone decreases while land suitable for pastoral use increases almost double the size. The 54% of the total land falls in this category, while land for arable use is about 23%. Remaining 14% land having small bushes and trees may have served as hunting ground. Barren land and water bodies cover 9% of the total area. In this area, a number of smaller settlements have been identified pursuing subsistence of agro-pastoral in nature. This factor is well demonstrated in the radius of 10 sq km area around the site.

The land within the radius of 10 km is alluvium mixed with loamy fine sand is categorised as the good fertile soil. However, due to high degree of secondary salinity, this land is relatively less ploughable as compared to those located in 5 km radius. Apparently the degradation in the quality of soil has taken place due to excessive agriculture which was not there when the Drishadvati was active till *circa* 2000 BCE. The ephemeral nature of water course gave rise to lakes and ponds around which agricultural activities continued. Modern relicts of palaeo-ponds in the vicinity corroborate such assumptions.

There are number of settlements in this zone which came into existence during the mature Harappan period which sustained small farmsteads at sites like Milakapur, Kinnar, Nara, Gunkali and Mirchpur during the mature Harappan period, while settlements at Gandaswala,

Sotha, Kinnar, Nara and Mirchpur continued to survive up to the late Harappan period.

Another type of soil present in this zone is semi-fossilised sand dunes covers 23% of pasture land. It grows grasses like *dab* (*sachrarum Spp*) and *doof* (*cyndondactylon*), useful for cattle or sheep-goat grazing. Over this pasture land are located smaller sites like Lohari Ragho 1, Lohari Ragho 2 and Kheri-Lochab of early Harappan origin. These settlements are situated quite close to the patches containing shrubs (*calotropisprocera*) *Jhar Beri* (*Zizyphus Spp.*) and trees like *Jalab* (*Slvodra oleodides*) and *Jand* (*prospis Spp*). These locations might have served as place for game. Lohari Ragho 1 is very close to the flood-plain zone of Chautang and so agro-pastoral subsistence base of this site cannot be ruled out. Though Lohari Ragho 2 and 3 are located on non-agricultural lands, some of the population might have been engaged in pastoral activities while others in craft activities (Garge 2006).

Occurrence of minerals like quartz, mica flakes, garnet towards the eastern and south-eastern side besides intermittent patches of *kankar* and alluvial soil in this zone suggest their local extraction as building material. Some of these minerals like silica and quartz sand might have been used in the preparation of faience paste as a number of these sites have reported artefacts made of faience. There are pockets of burnt bricks production centres operating currently from some of the villages located in this zone. The evidence of burnt bricks start occurring from the early Harappan horizon at Rakhigarhi attributed to 4th millennium BCE.

From the settlement of 15 km radius

Within the radius of 15 km, the area covered is 707.2 sq. km. Though percentage of arable land reduces to 47%, it remains dominant. Percentage of pastoral land increases to 38%. Land covered by bushes is 9% and 7% of this area falls in category of barren land.

The distribution of satellite sites in the area between 10 km to 15 km is concentrated in northwest and southwest. The sites located in the northwest are of mature and late Harappan origin while the sites located in the southwest show a continuity of occupation from early, mature and late phase of the Harappan culture. Both the clusters of sites are located on ploughable land. The sites in northwest such as Panhari, Gyanpura, Sotha, Kagsar and Sulchani and those in southwest namely Sisai 1, 2, 3, Rajpura 2 and Pali are situated in class one agricultural land. A cluster of small size early, mature and late Harappan settlements around Masudpur falls within 12 to 15 km to the southwest of Rakhigarhi. It is located in the upper reaches of runnels which irrigates the surroundings of Rakhigarhi. The source of these parallel running runnels has been blocked due to the westerly accumulation of sand dunes. These runnels and other palaeo-channels have contributed to agro-pastoral character of the site. The late Harappan settlements could survive on these water bodies when Drishadvati was drying up.

From the above discussion, it is apparent that basic subsistence requirements of the Harappans at Rakhigarhi were met within the local catchment area since its first occupation. The economy of the pre-formative phase at the site was primarily agro-pastoral in character with certain amount of craft activity. During the formative stage of the early Harappans the site witnessed exploitation of area within 5 to 10 km when a number of farmsteads have emerged as agro-pastoral hamlets. There is a surge in terms of long distance interaction based on exchange of material culture. The archaeological data of chert and other semi-precious stones, metal, shell and so on from these levels suggest a rise in industry and trade. The production of status objects compelled the Harappans towards developing an exchange mechanism in the procurement of some of raw materials which were not available within the premise of catchment. The concept of cottage industry as part of subsistence had its beginning when the Harappans had acquired self-sufficiency in agriculture produce.

To sustain the cottage industry, raw materials like rocks, metals and other organic produce were largely procured from distant land covering the sub-Himalayan region, Jammu and Kashmir valley, Northwest Frontier Province, Sindh, Gujarat peninsula and the Aravallis, in addition to those available in the surroundings of the Sarasvati-Drishadvati valley.

Stone

Plenty of stone objects have been collected from pre-formative stage of occupation to the mature Harappan stage. These food processing equipments as well as implements are mainly of quartzite with a minor percentage of sandstone and quartz. Among this, quartz is found in older alluvium deposits of Drishadvati near Rakhigarhi, however in limited quantity. The nearest source of quartzite is at Tosham in the Bhiwani district of Haryana which lies 70 km southwest of Rakhigarhi. Though these mines have evidence of ancient working (Kochhar *et al.* 1997), the Harappans seems to have not utilized this grey quartzite from Tosham mines.

Another source of quartz is at Kaliana hills, an extension of Delhi outlier zone, lying 72 km south of Rakhigarhi, seems to have been exploited on a large scale by the inhabitants of this region. Quartzite from this area has a sugary texture, is red-pink to pinkish grey in colour and is crisscrossed with thin hematite and quartz filled fractures. Stone objects found in excavations at Rakhigarhi besides Kalibanagn, Mitathal, Siswal etc. are dressed out of stones from Kaliana hills. Apparently, the stones of Kaliana hills keeping in view their homogeneity, grain size and toughness, may be compared to the stones available in the Kirana hills which are relatively superior in quality for preparing grinding stones. This source has been exploited by the Harappans located on the Ravi (Law 2008: 237). The geologic provenience analysis carried out in respect of 665 grindstones from Rakhigarhi, the source of 555 of them could be determined. The types of

stone identified are: quartzite from the Kaliana Hills in southern Haryana; water-worn cobbles of various kinds from the Himalayan foothills region; Pab sandstone from the Sulaiman range in Pakistan; and Mathura sandstone. This data has given a definite account of procurement strategy with regard to food processing equipments as well as apparatus for game birds and animals. It is interesting to note that out of the 665 objects examined 228 have been reported from R.G.R. 6 which has given a sequence of culture of the early farmers of the pre-formative stage assignable to circa 5th millennium BCE succeeded by the early Harappans (formative stage) attributed to circa 4th millennium BCE (Table-1). The chronological framework of above noted data categorically points to the of the corss-country acquisition manoeuvre as early as 5th millennium BCE, which is a landmark revelation.

A few objects made on grey sandstone cobbles are also reported within the catchment area of Rakhigarhi. These cobbles are found in the upper reaches of streams originating in the Siwaliks located say 150 to 200 km to the east and northeast of Rakhigarhi. Some of these cobblestones rolled down the stream and are found in their beds close to the settlements. Fine grained yellowish sandstone objects reported from Rakhigarhi has its source in the Mathura-Bharatpur terrain located roughly 200 km towards the south.

Metal

Copper objects start occurring from the early Harappan horizon and remains in vogue throughout the occupation. The general observation with regard to procurement of copper to the settlements is in the form of ingots prepared at the site of source. These ingots were melted in order to shape the objects at the settlements. Rakhigarhi is not an exception to this belief. A good number of terracotta crucibles found at the site suggests copper melting activity. The nearest source of copper to the site was Khetri mines in Rajasthan. The spectroscopic analysis of the Harappan artefacts and various

ores show that there is a close correspondence with the Khetri mines (Agrawal 1971) where copper working areas have been identified dating back to 3rd millennium BCE at sites like Ganeshwar (Agrawala, 1978; Agrawala and Kumar 1993). The possibility of other sources of copper may not be ruled out. The Geological survey of India in 1981 has reported local sources at Narnaul-Khodana and Tosham in Harayana. The Naranaul-Khodana area is possibly an extension of well-known Khetri belt from Rajasthan. At these mines, the exposures are mainly confined to small low hillocks not exceeding more than 100 m. Ancient copper workings with mine spoils scattered over a length of 8 km are extended from Phani-Umrabad to Khatra hills. Geologists conducting fieldwork in areas of the Himalayas ranging from Kashmir to Uttarakhand have noted hundreds of old mine shafts, open pits and slag heaps related to the extraction and production of copper (Dass *et al.* 1964; Middlemiss 1929; Nandan *et. al* 1981; Sharma 2002).

Tin is another metal used as alloy in the manufacture of tin-based bronzes by the Harappans. As per the studies of Harappan finds, only 14% of the tools were alloyed in the optimum range of 8-12% tin. The closest source for Rakhigarhi for tin is again Tosham mines (Kochhar *et al.* 1997). Other known sources are Bhilwara in Rajasthan and Hosainpur in Gujarat. However the main supply of the Harappan domain seems to have reached from Khorasan and the area between Bukhara and Samarkand (Chakrabarti 1979:70) via Shortugai.

Like any other Harappan site gold objects and ornaments found at Rakhigarhi are of identical nature which included beads, pendants, rings, coiled spring, fillet, foil etc. It is generally believed that the Kolar mines had served as source of gold to the Harappans (Marshall 1931: 674; Rao 1973: 116). The other mechanism of extracting gold was panning or washing deposit of sand, gravel etc. from the bed of a stream or runnel etc. Data of panning placer gold in fresh alluvium from the upper reaches of Ghaggar, Sutlej, Vyas (Gee 1948: 11; Schmidt and Mathews 1992) and Ganges are available. It is also reported from Achintanag, Jammu and Kashmir, Ajmer,

Sirohi and Jodhpur in Rajasthan (Ziauddin and Narayanswami 1974:135,144,149,154)

There are traditional connotations in the *Rigveda* inferring the Indus (*RV*, X.75.8) as *hiranayani* and *hiranyavartani* i.e., containing gold. Likewise in another hymn (*RV,* VI.61.7) an identical adjective of *hiranyavartani* has been used for the Sarasvati river (Dubey 2007). Both these inferences extrapolate geologic data obtained from the upper reaches of contiguous rivers noted above. In all probability the Harappans at Rakhigarhi exploited both these sources for the yellow metal.

Silver and lead artefacts reported from Rakhigarhi excavation are limited in number (Nath 2006) which included beads, rings, bangles and other ornaments of silver, besides a lead ingot of plano-convex shape inscribed on both the sides. The Vedic and later Vedic sources refer the use of lead ingots in the craft of weaving besides medium of barter and medicine (Biswas *et al.* 1996:20). The inscribed lead ingot found at the site might have served the purpose of a token-exchangeable for goods of specific kind or given as gift.

The nearest source of exploitation of these metals lies in southern Baluchistan, Rajasthan and sub-Himalayan region. The sub-Himalayan sources have noted the existence of scores of disused mine shafts, pits, slag heaps and waste dumps of ancient times (Sharma 2002). Old workings of lead are also found on the outskirts of Ajmer city at Lohakhan, while rich deposits Udaipur, Rajsamand and Bhilwara are well known.

Three silver and two lead specimens from Rakhigarhi were subjected to isotopic assay to determine the acquisition pattern on the lines of database derived from other Harappan sites. Incidentally, the process of assaying led to a heterogeneous feature which did not reveal exact source to these finds. However, the analysis laid bare a 'mixing line' between a southern Baluchistan deposit and an unknown source(s) (Law 2011). Since

Rakhigarhi is close to southern Rajasthan and sub-Himalayan sources, possibility of exploitation of these sources for acquisition of silver and lead ingots may not be ruled out.

Semi-precious stones

Steatite appears to be a popular mineral for the Harappans at Rakhigarhi. It may be noted that 70% of the beads are made from steatite. The major sources which supplied this mineral to the Harappans are north Gujarat, Degota, Gisghar, Morra in Rajasthan (Marshall, 1931) and northern Baluchistan besides Jammu and Kashmir. The sources of Jammu and Kashmir region, although located in highly mountainous and often difficult to reach were apparently exploited by the Neolithic settlers of Burzahom to meet the demands of the Harappans. Other prospective source of exploitation could have been the northeastern part of the Aravallis. Sources for colorful steatite akin to the Harappan samples lie in the open pit mine at Degota, Dausa District, Rajasthan which produces some of the highest grade soapstone in India (Law 2008: 332). Out of the four specimens analyzed from Rakhigarhi, three belong to Hazara (KPP) mines and one to Safedkoh range; both sources are in Pakistan. Other unanalyzed artifacts from the site eventually may reveal exploration of nearby sources of Alwar and Jhunjhunu as Harappa, Mohanjodaro and Mitathal (Prabhakar *et al.* 2010) have already reported artifacts from these sources. There is evidence of exploitation of Aravalli sources by the Chalcolithic inhabitants of Ganeshwar-Jodhpura culture during the 3rd millennium BCE (Agrawala and Kumar 1982; Rizvi 2007). It is quite likely that the Harappans were interacting with these Chalcolithic inhabitants for acquisition of steatite.

Faience was another important material used by the Harappans at Rakhigarhi and other settlements in Ghaggar and Chautang basin. A faience working kiln is reported from mound RGR-2 of Rakhigarhi along with large number of finished objects such as bangles and beads (Nath, 2006). Some satellite settlements of Rakhigarhi have shown faience working areas (Garge,

2006). To produce these objects, powdered rock quartz was combined with a colorant. Quartz pebbles are located in the upper reaches of the rivers originating in the Siwaliks. These might have been transported to a great distance during floods in the past. The older patches of alluvium and river sand may have been a good source of silica, besides the shifting sand dunes from the west. The sites located close to these sand dunes have had a tendency to produce faience objects. The above premise is based on data obtained from sites located in the proximity of relicts of sand dunes.

Among the semi-precious stones, beads made from reddish-orange variety of agate known as carnelian have been reported at Rakhigarhi where, incidentally, evidence of a major lapidary craft with debitage of different stages of manufacture have come to light, including drill bits and bead polishers. Five carnelian samples have been subjected geologic provenience analysis which revealed exploitation sources located at Khandek, Mardakbet and Ratanpur of Gujarat, supporting the earlier noted resource pattern (Allchin 1997: 173; Ratnagar 2004: 146; Ratnagar 2012:77).

Chert blades are integral part of the typical Harappan assemblage. These blades in the early Harappan context have been found in association with microlithic tools at Kalibangan (Lal *et al.* 2003: 223-28), Harappa, besides Mohenjodaro (Pracchia *et al.* 1985: 237) and Rakhigarhi in the mature Harappan context. Occurrence of these microliths in the early Harappan context indicate certain Mesolithic antecedents. Appearance of chert blades and microliths together may imply coexistence of two systems of exploitation of different raw materials, by different group of people, answering different needs (Inizan and Lechevallier, 1990: 51). The site has reported blade flakes and fluted core of chert in the early Harappan context (Nath 1999: 48). The occurrence of blade pressure debitage suggests existence of organised long distance network in the lithics as early as 4th millennium BCE to cater the need of the Harappan settlements in the Sarasvati-Drishadvati valley. It was a profitable trade in prepared cores for the convenience of knapper to start production straight away and save time

in preparing the core as well as minimize the wastage of precious imported commodity. On an average a core could produce forty to fifty blades (Inizan and Lechevallier, 1990: 51). An identical blade pressure debitage has been reported in the upstream of Drishadvati at Balu (Kesarwani 2001) which might indicate the source of procurement of prepared core at Rakhigarhi being the central mart on the river course.

Artifacts made of a tan to grey-colored chert that often has a distinctive banded pattern have been recovered from strata representing early and Mature Harappan periods. Likewise, tan-grey chert, banded at times, have been found distributed across the Harappan sites (Ratnagar 2001: 64) and is widely believed to have originated in the Rohri Hills of Sindh (Allchin 1979). This source bears signs of exploitation, which largely used to cater the requirements of settlements across the Sarasvati-Drishadvati valleys. As regards, the exploitation of black chert reported from the Neoproterozoic Great Limestone formation of Jammu (Raha 1984) depends on contextual occurrence of finds in the Harappan context.

Lapis lazuli and sodalite are more or less akin to each other, except the latter is darker in colour. These have generally been used in producing beads. The well-known mines of Afghanistan are the most likely source of lapis lazuli. These are located in the Kerano Munjan district of Badakashan province in the Hindukush Mountains (Herrmann, 1968). Sodalite is quarried in the Aravalis near Kishngharh in Rajasthan (Chakrabarti 1978). Of these two, lapis lazuli is a precious commodity for bead making hence number of sites have received its end products, so is the case at Rakhigarhi. On the other hand sodalite quarried from Ajmer region relatively turned out to be an economical substitute to those buyers who possibly could not afford the products of lapis lazuli.

Bones and ivory

The exploitation of long bones of wild and domesticated animals starts from the beginning of occupation at the site. In the process of making tools and implements, long and medium sized bones were preferred, besides antlers as agricultural implement. Among the distinctive finds, from the early Harappan assemblage of RGR 6 is seven specimens of worked astragali of cattle. These have been identified as hunting whistles (Thomas 1988: 823). In an isolated eastern slope of RGR 5 the excavation has revealed a definite evidence of craft area pertaining to bone and ivory. The cutting has reported bone points of different stages of preparation (Nath 2001) Abundance of faunal data bearing use mark suggests their function largely as tool or implement. These species were available in abundance in the periphery of the site; hence it may be presumed that bones of both domesticated and wild animals were exploited in tool making since the beginning of formative stage at the site.

In association with the bone tools debitage, the same cutting of the RGR 5 has further reported a worked core of ivory, besides finished status objects like comb, dice, balance and rod attributed to the mature Harappan levels. The foothills of Sivaliks could have been the probable source of ivory for the Harappans at Rakhigarhi. Location of bone and ivory craft centres towards the eastern margin of the matured Harappan occupation at the site denotes primary working area, apparently earmarked under certain norms of the settlement strategy.

Shell

Objects crafted out of shell form part of the imported commodities at Rakhigarhi. These objects are essentially made of marine shells which starts occurring from the formative stage of the early Harappans. Its presence in the stratified cuttings at the site and on surface at Lohari Ragho, a satellite site, is indicative of raw material being imported and redistributed to substantiate local craft industry (Garge 2006). The closest source of marine

shell was Gulf of Kutch in Saurastra region located 800 km away from Rakhigarhi. A bangle fragment reported from the early Harappan horizon indicates an early participation in the procurement of shell object. However in the Mature Harappan period the shell craft becomes an important handicraft. One of the floors has been identified as shell working area at the site (Nath 1998). Being an auspicious imported commoditity, the shell workshop has been found located in the cuttings of south central part of RGR 2, indicating considerable supervision over the end product.

Timber

Use of timber, reed and bamboo as building material has been evidenced from various stages of occupation. Pieces of wattle and daub, post-holes have been noticed in the pre-formative stage of occupation (Nath 2001) while an impression of wooden post has been seen across over a mud brick wall in the cuttings of RGR 6. A dressed wood-sleeper has been found laid over the staircase in the cuttings of RGR 2. Apart from these, wood also serves as source to fuel requirement, substitute to cow dung cake. These data imply commercial exploitation of timber from the nearby gallery forests located in the flood plain of Drishadvati as well as from the piedmonts of sub-Himalayan region. There are Vedic inferences to such exploitations (*RV,* X.28.8) besides floating of unmanned timber (*RV,* X.155.3) through the river downstream (Singh 1997). Among the favoured list of timber features *pitadaru* and *devadaru* besides *sissoo* (*Dalbergia sissoo*) and *khadira* (*Acacia catechu*) as wood required for fabricating axel and hub of a wheel. The site has reported terracotta models of wheels of spokes (*sararatha cakra*) and solid (*paridhiratha cakra*) variety (Nath 1998). A couple of samples of *khadira* (*Dalbergia sissoo*) have been identified from the mature Harappan levels at Kalibangan (*IAR 1975-76*:87). It is believed that the ploughshare dressed out of *khadira* or *khair* was invoked in prayers to bestow wealth (*AV*, X. 6.23). Even today wooden models of ploughshare form part of marriage rituals. Symbolic terracotta models of ploughshare which might have served some ritualistic function have come to light from this site as well as from

Banawali (Bisht 1987; *IAR 1983-84*:26.Pl 21). These terracotta models corroborate above noted literary inference. It is quite likely that the wooden ploughshares were introduced (Sharma 1983:25) in the proto historic period by the early farmers in tilling the alluvial river plains of upper Rajasthan, Haryana and Punjab.

Conclusion

From the foregoing discussion, it is apparent that the application of model-site catchment analysis has provided significant database for the study of subsistence based management of resources. The site of Rakhigarhi is located between the peninsular landform formulated by the runnels flowing on either sides of the picturesque landscape. Such an ecological niche tempted the first settlers of the pre-formative stage (5th millennium BCE) to occupy the area who had knowledge of farming, animal husbandry and certain craft backup. Logically, the resource management of the pre-formative stage was confined to a radius of 5 km. During the formative stage of the early Harappans (4th millennium BCE) the local area of exploitation widen up to 10 km-15 km radius. It is discernible that a number of farmsteads cropped up around the site during the formative stage, later grew into hamlets. Evidently, the site had started participating in the long distance exchange net work with the peninsular region of Gujarat, Sindh and the Aravallis. During this period, the concept of settlement pattern has evolved. The houses were planned parallel to the street and house drains were terminating into the public drains. Crafts like bead making, spinning and textile dyeing, variety of brick manufacturing besides pottery making were in vogue. The potter's kiln reported from RGR 1 is brick lined of rectangular shape. The preliminary study of petrography of ceramics from this region has revealed open fire baking kilns in the pre-formative stage. As regards the procurement of clay it is observed that more than one source were exploited (Krishnan *et al.* 2012). It is quite likely that the alluvial soil within the local catchment were exploited for pottery making since pre-

formative stage. Visibly, the red ware and chocolate slipped ware were quality products of that era.

The locational analysis of Rakhigarhi reveals it to be a major settlement which was in a position to take advantage in the procurement of commodities from its locale as well as distant surroundings. The size of the settlement over different archaeological mounds has been calculated to 118 hectors which excels in dimension to other sites located in this valley. The predominance over the neighbouring settlements indicate a rural marketing situation where emphasis was given to infrastructure facilities like transportation of raw material and its distribution amongst the rural centres and marketing of finished products. The economy of the site thrived on both external exchanges of commodities as well as internal distribution of surplus. For surplus produce, ingenious mechanism of irrigation was developed. The site had a direct control over the movements of raw material and finished products. Therefore it could emerge as one of the 'gateway cities' (Ratnagar 1993: 264) of the eastern domain of the Harappans in the Sarasvati-Drishadvati Divide.

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Chapter 4

The cuttings and the Stratigraphy

The cuttings were taken at RGR-1, RGR-2 and RGR-4 to understand the settlement pattern of the Harappan metropolitans. The cuttings of RGR- 6 were carried out to understand the formative urbanism beginning from the early Harappan period. The similar deposits of the early Harappan nature were noticed also on the other mounds namely RGR-1 and RGR-2. The cuttings at RGR-5 has reveled the bone making industry. The RGR-7 has revealed the evidence of Harappan cemetery. Keeping in view, the topographical features of the mound the whole area is divided into citadel, middle town and lower town as per the situation of the site. In the first and second season, after hard working the entire contour plan of the site was prepared. Then after each mound has been marked in grids of 10m square and bisect 1m baulk from each grid. In the first season few trenches have been dugout it is in RGR-1 trenches f6, f7 in RGR-2 trenches in the second season large number of trenches have been dug in the RGR-1, RGR-2 and RGR-6 (ARDA) to confirm the first year evidence which was partly excavated. In the third season 99-2000 few more trenches have been unveiled to understand the plan of city. In the RGR-1, RGR-2 continuous raw of trenches were dug from east-west and north-south direction to find out cultural remains and structural body (1) Any rampart and structures there in between (2) to know the cultural sequence at the site by digging at the few points in the higher and lower areas of the mound; (3) To uncover the residential complex (4) the collect floral and faunal remains in successive stage and know is utility in the periods as a process of subsistence pattern (5) To find out structures of the earliest period in the citadel, middle town and lower town (6) To confirm the extension of the site few trenches were also laid in the lower elevation of the mound.

The Cuttings:

RGR – 1

The general configuration and extend of the mound and its environs are described in chapter 1 and chapter 2. The purpose and layout of the cutting made from time to time may be noted here. The cutting RGR-1 was the first made in 1997 in the highest part of the western half of the mound with view to obtain maximum cultural deposit. The flanking peg system was followed here. Since the main purpose was to determine the sequence of cultures by vertical digging. Out of 6m deposit, 4m belongs to period 1 (Early Harappan) and 2m belong to period II (mature Harappan). This cutting which is incidentally the largest is laid out in a grid system with a view to extend the operation in any direction. Each gird is 10m square. The trench extends northwards and south wards to follow a street.

The cuttings of RGR-1 have all the phases and sub-phases of structural activity in a stratified context. From the point of view of stratigraphic and cultural sequence the grid K3 is important since all the successive deposit of periods I and period II. Structural remains of period I and period II are traceable over a considerable area towards the northern to southern extremity of RGR-1. Among important buildings laid bare in this cutting mention may be made of following J-5, J-6, K-5, K-6, L-5, L-6, L-7, N 10, N11, P 10, P11 and R 3.

RGR-2

This cutting is grided and extended from the western of the mound RGR-3. The grid system was extended to the southern slope of the mound in order to expose the platforms, marketing place, granary and fortification wall. Remains of the sanitary arrangements made in the form of baths, drains, manholes, cess-holes etc. can be seen in the south central cuttings.

The super structure of the podium is found destroyed by erosion. The existence of streets and lanes joined in a chess board pattern.

The podium in south eastern extremity is also benefit of the super structure which appears to have been built of some perishable material like wood. There is absolutely no trace of any building material raised over the platform in the south-eastern extremity.

Street 1, public drain joint with a main drain, which running north-south on the western slope of the mound. The great care taken in signifies status in the Harappan world by building platforms of mud and mud brick on all sides signifies its importance. The western arm of the fortification wall forming the defense is also included in RGR-2.

RGR-6

The cutting RGR-6 made in the central part of the mound with a view to ascertain the early Harappan structural remains. Among the structural remains found there in mud brick house, street and circular hearth within this M11, M12 cutting five phases of early Harappan structure has noticed.

RGR-7

The cutting R-20 of RGR-7 was laid at the centre of the mound a 500m north of RGR-1 with a view to trace the Harappan cemetery ascertain the stratigraphic relation between habitation area and the cemetery.

The cemetery mound is slightly elevated land full of alluvial flood land full of flood sand, long after the Harappan the site has been used by Kushana people, because are final trench in the north east at a distance 100m from R-20 has evidence of Kushana pottery.

OTHER CUTTINGS:-

The trench made in the south-eastern corner of the RGR-5 with a view to trace the Harappan cemetery but from this trench large amount of bone implement of different manufacturing stage has been come out. One ivory comb has reported from this trench.

The cutting of RGR-4 with a view to trace the extent of the large podium, which was partially exposed in the south –eastern corner of the RGR-2.

Mention may be made of the cutting which possible the part of fortification wall and its narrow enhance extending north-south direction in about 20 m.

STRATIGRAPHY:-

Stratigraphy is the study of stratification the laying down on depositing of strata or layers one above the other. It was long understood by geologist before it became common place in archaeology. The protagonist in the geological use of the term was William “strata” Smith who, in 1816, began the issue of a work entitled ‘strata’ identified by geological fossils those by opened up new geological profundities and successions. Good stratigraphic excavation at an archaeological site id designed to obtain such a sequence part of this work involves defecting whether there have been any human or natural disturbance of the layers since they were originally deposited.

In order to follow the stratigraphy of the site of is necessary to understand the layout of the main towns and main buildings. Originally Rakhigarhi was a city surrounded with distinction area, the maximum area; the maximum part is occupied by the present villagers and the some part of it changed to cultivated landing a recent year.

The important sections have been referred to him. The section look north runs from east to west along street and platform of various phases. The total length of the section is 9 m out of which the more important portions are illustrated. The section has shown four successive phases.

SECTION LOOKING EAST:-

In the RGR-2 one more section has been incorporated to relate with other mound. The section came across two successive periods and a few platforms have been exposed, clearly visible in the section. The section I connected with outer part of the podium.

THE PROBLEM:-

The main purpose of understanding excavation at Rakhigarhi was to decide whether it could be considered as the true Harappan settlement where people observed same urban discipline and enjoyed the same material prosperity as in the metropolitan centers of Harappa and Mohenjodaro. The careful planning of the town and the excellent sanitary system proved that it was a true Harappan town.

A. THE GRANNERY:-

The second problem relates to granary, roughly a 'L' shaped massive structure within 10 number of small room. Initially it was found difficult to determine its use. Later o it was ascertained that the structure served as a granary wherein grains were stored.

B. THE PODIUM:-

The third which had to be talked at Rakhigarhi was similar to Kalibangan religious platform, located on the southern part of the mound.

Initially it was found difficult to determine its use, later on it was ascertained that the two more structures as religious platforms and other were used for same warft platform.

C.EARLY HARAPPAN CULTURE:-

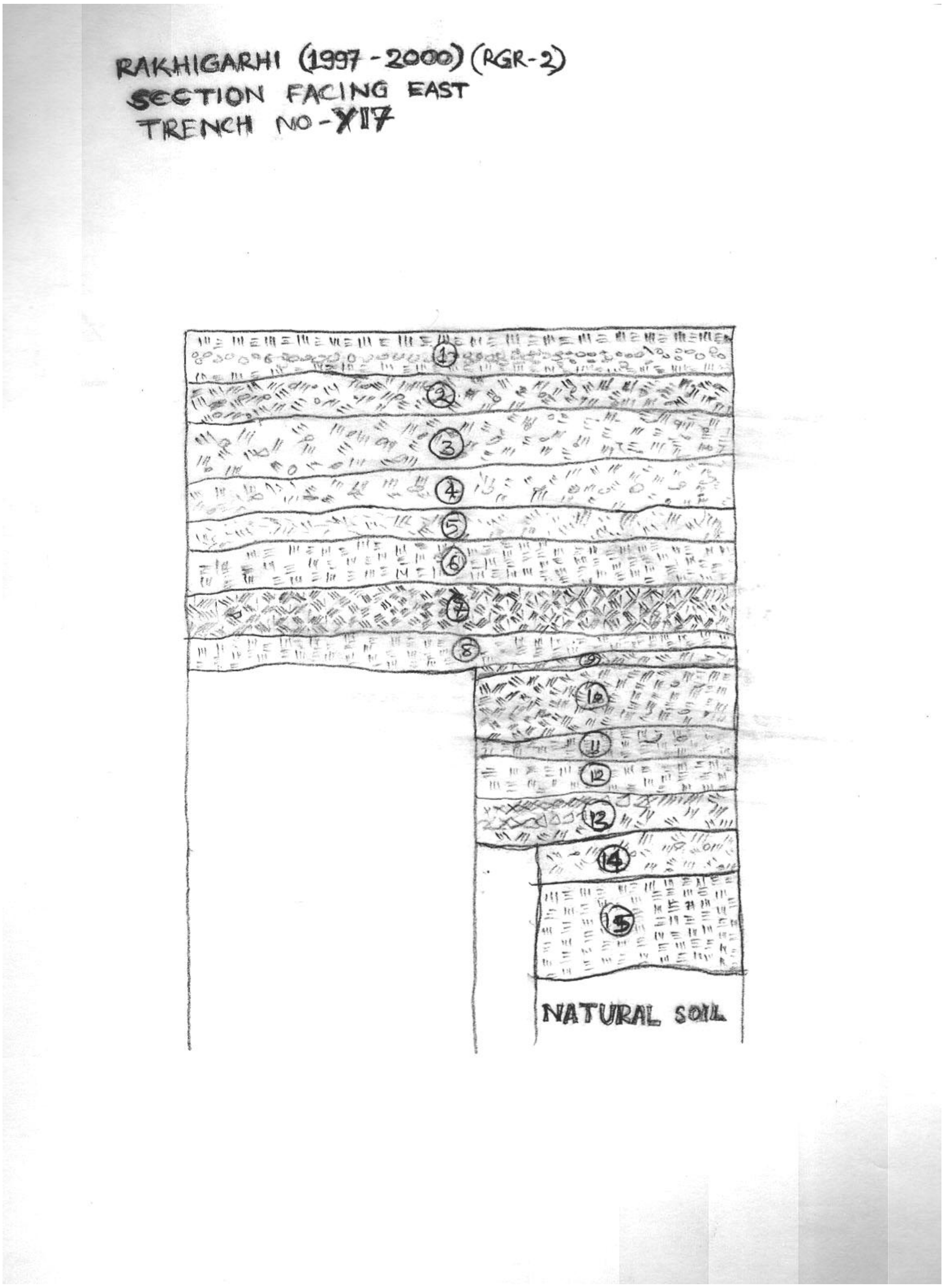
Lastly the Hakra element pottery which epic center is Saraswati basin is dominant before these Harappan establishment their settlements on the Rakhigarhi. Along with the distinctive based culture rarely found indicate that the purple red ware indigenous to the soil and had obtained a fairly high level of economic development. These early Harappan element have been traced in RGR-1, RGR-6 in well stratified layers.

3.3 CULTURAL SEQUENCE:-

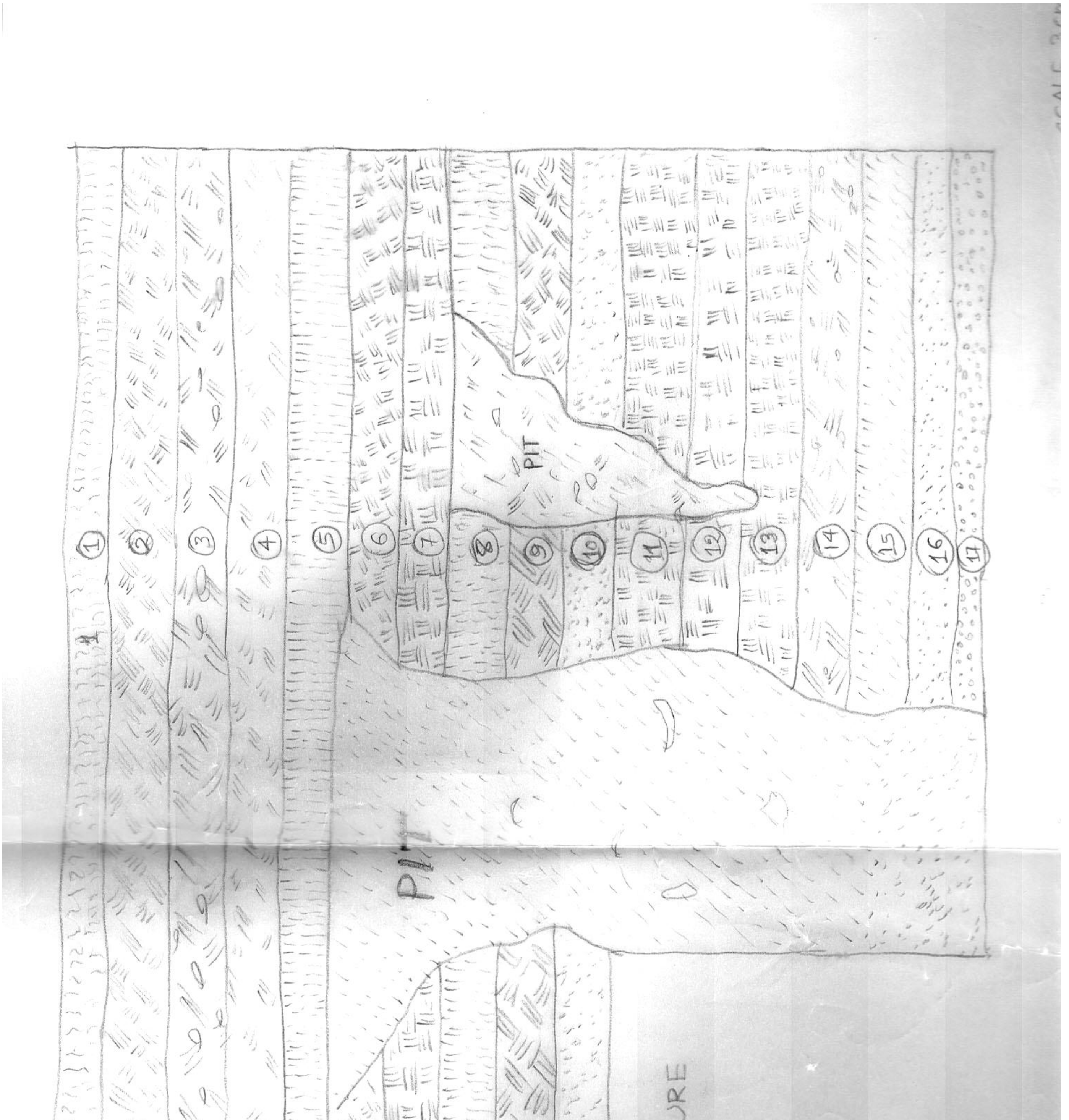
The two folds of the Harappan civilization at Rakhigarhi, one representing its childhood and the other its maturity have been designated as period I and period II respectively instead of period A and B. To distinguish cultural periods from the structural periods the latter have been termed as phases accordingly, the three phases of building activity noticed in period I are numbered from bottom 1 to 3 which the mature period have been noticed three phases of structural activity. The following cultural periods structural phases may be noticed before going into details:-

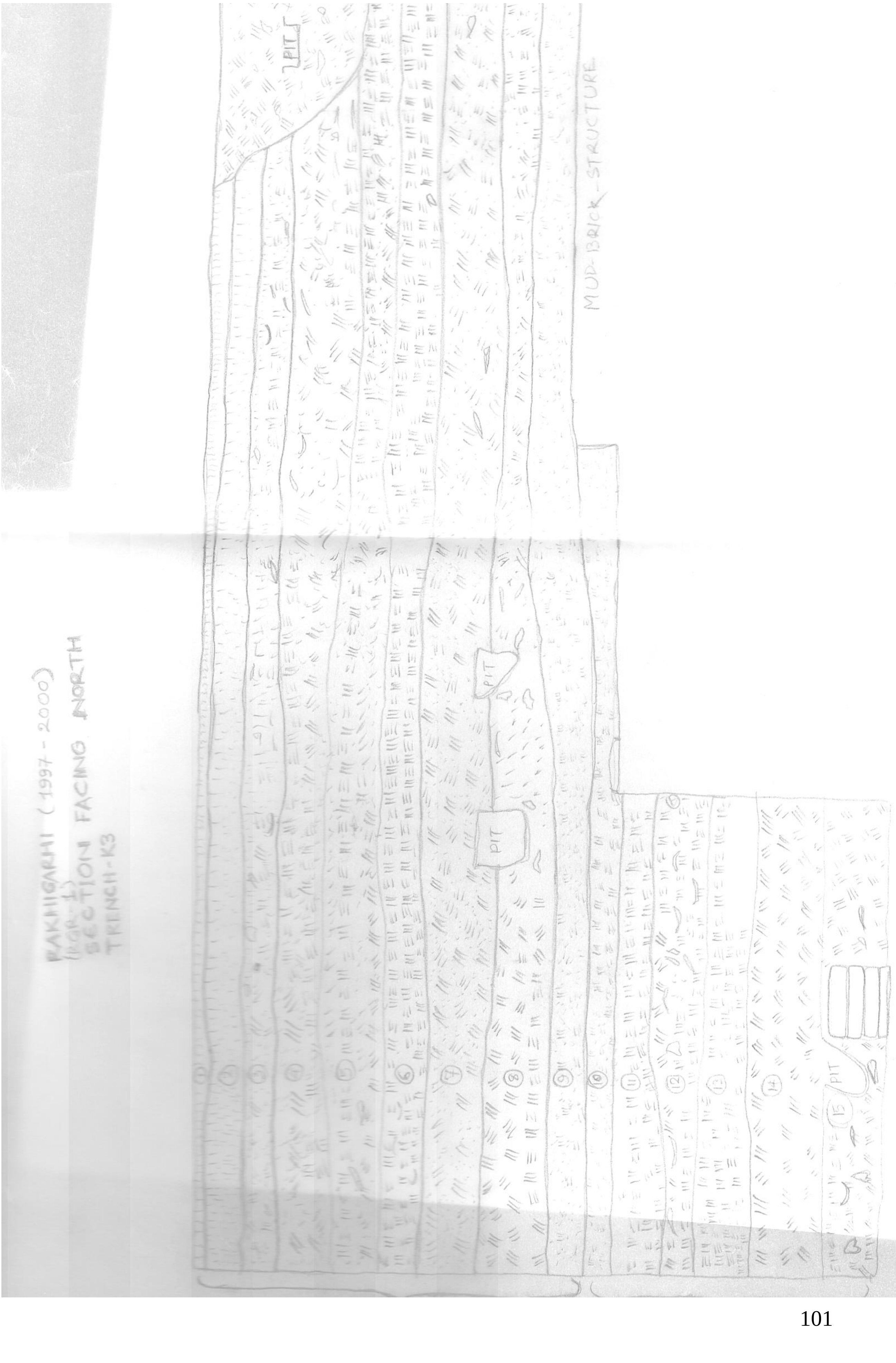
Period	**Phase**	**Sub phase**
Period I Early Harappan	Phase I Phase II Phase III	 Sub phase II A Sub phase II B
Period II Mature Harappan	Phase IV Phase V	Sub phase IV A Sub phase IV B

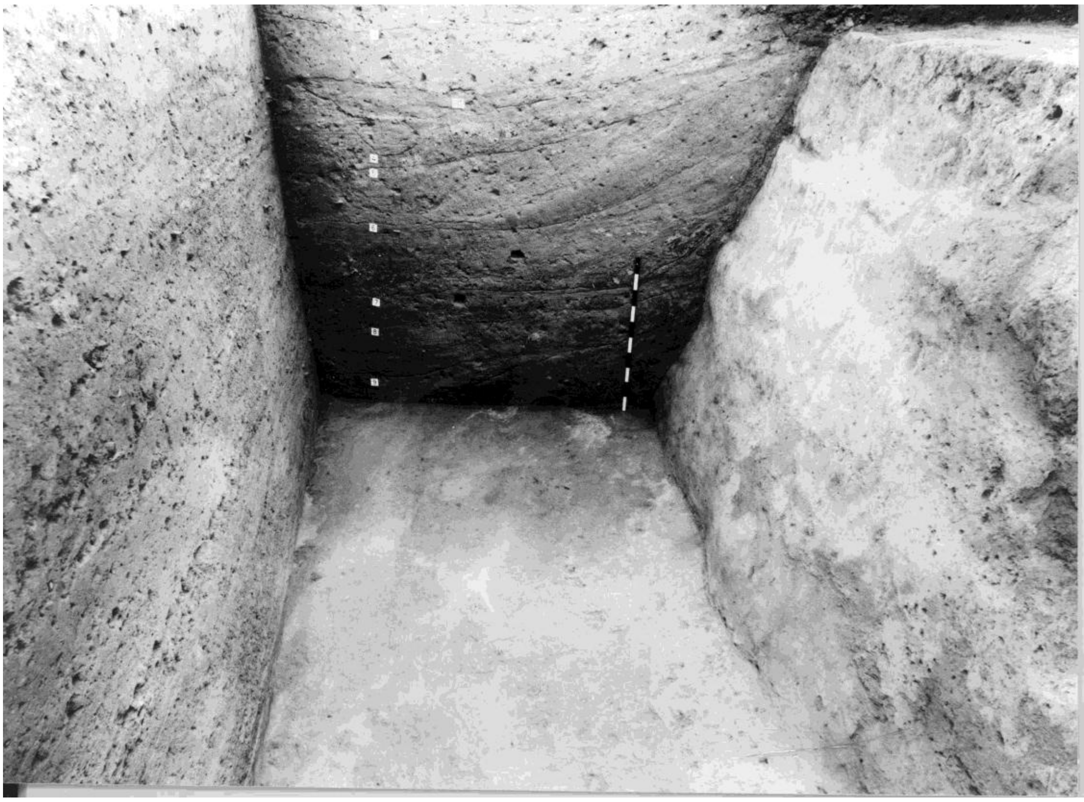
	Phase VI	



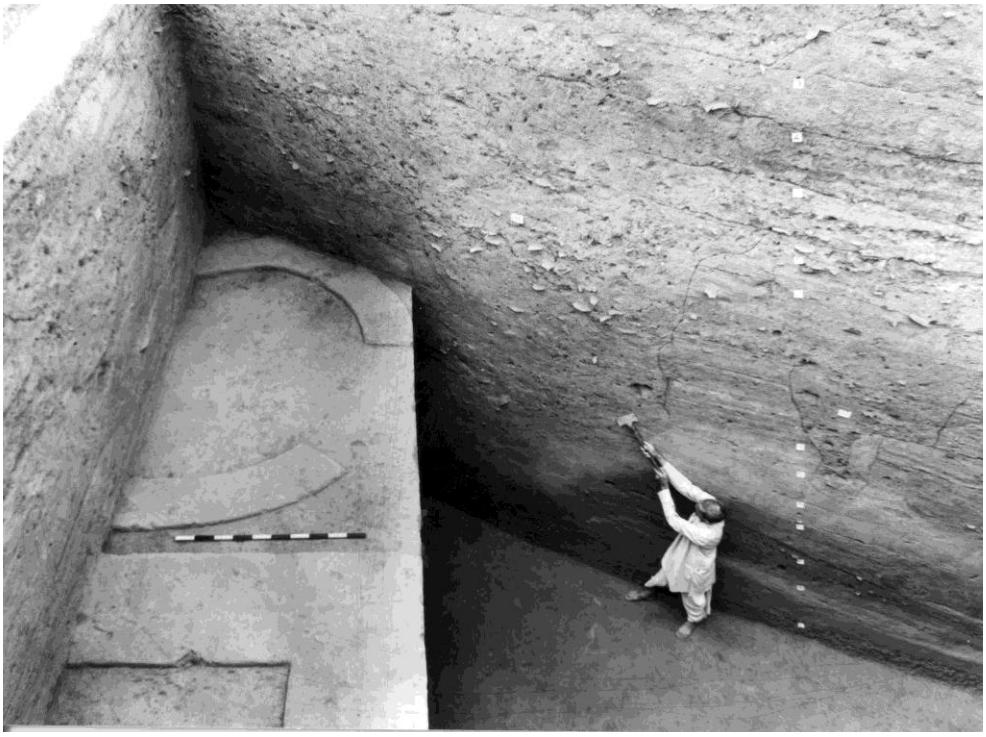
RAKHIGARHI (1997 - 2000) (RGR-2)
SECTION FACING EAST
TRENCH NO-XI7
NATURAL SOIL


1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
PIT
PIT
STRUCTURE


RAKHIGARHI (1997 - 2000)
(RGR-1)
SECTION FACING NORTH
TRENCH-K3
PIT
PIT
PIT
MUD-BRICK-STRUCTURE



4.1 The deposition of layer against the citadel wall



4.2 Stratigraphy of RGR-6

Chapter 5

Structural Remains

Rakhigarhi was structurally vacume when the Harappan arrived and settled, it was through flood deposit over the early Harappan structure. The earliest occupation of the deposit of period I, which is as much as 4 to 6 m in RGR-1, RGR-2 and RGR-6, has interesting quantity of Hakra element in the lower level corresponding less in the Harappan wares.

Because of the fertility of the land and Drishadvati channel (now dried up) attracted the Harappans to settle at Rakhigarhi. Their arrival and settlement in period I appear to be a slow and peaceful process, as there is neither any evidence of violence nor sudden influx of the new comers. After their arrival they gradually introduced their ceramic wares, lithic tools and metal equipments. The local population might have adopted the superior tools and weapons as also new standards of weight and measures because of the advantages they conformed. Attempt was also made to introduce civic amenities such as public drains, streets and networking wells.

Unlike present day emergency plan the Harappans must have prepared a blueprint of the proposed town before providing all the civic amenities. The neatly laid out platforms, streets and drains, the provision of public wells, the separation of industrial area from industrial localities, the arrangement of the houses in a rows, the erection of fortification walls of uniform width and more than all construction of the grainary, religious podium and series of other podium clearly suggest careful planning and efficient execution with utmost precision. Execution of public works on large scale was not possible without genius who could enlist the cooperation of habitants to organize skilled and unskilled labours. As he was held in high regard he occupied the best mansion with best available civic amenities and built on highest platforms so that the seat of authority. The lower town where merchants, craftsman and other lived also enjoyed the civic amenities.

The most interesting feature of Harappan Civilization is its homogeneity, uniform products of the Harappan craftsman artists can be found in all cities and town throughout the vast territory which came under influence. Having realized the advances of the standardization, the Rakhgarhi people produced tools, weapons and ornaments conforming in quality to form the standard obtaining in the Indus valley. This explains the occurrence at Rakhigarhi of intaglio, seals, cubical stones, parallel sided blades, gemstones, copper implements and earthware similar to Mohenjodaro and Harappa. Rakhigarhi made a substantial contribution to enrich the Harappan Civilization in the scientific and technical fields. An instrument resembling to the compass to measure angles and among other improved tools can be mentioned as ivory scale, terracotta plumb- bob were also used.

The full-fledged settlement of the Harappan witnessed in period II of phase IV and V. The early Harappan witnessed prosperity in period I of phase II and III. There is no evidence of the decline phase at Rakhigarhi. The local industries pottery, bead making and flourishing trade seems to have stopped all of a sudden. After the Harappans abandoned, the site was reoccupied in the Kushana period. The detailed description is as follows:-

PERIOD –I

Based on structural evidence period I is subdivided into three phases. In the early level of the phase I the dendrite and Hakra ware is quite common, the red ware and course grey ware are also found along with Hakra element. In both the cases the pottery is well fired and the shapes are well formed Black and brown horizontal band around the shoulder and neck portion are more signify it aesthetic value. The occurrence in phase I of several Induct objects such as steatile bead, whetstone, bone point and ceramics forms such as the vase Goblet, jar with bulbous body, plain dish and varieties of bowl.

In the period I of phase II which is divided in to sub phases IIa and IIb with a genius planning of north-south direction street with nullah and to check the saline water profuse burnt brick has been used for making the

house floor and demarking the floor area burnt brick are also used. Such type of floor has been unearthing of RGR-1, and cover all over the mound, possible used for industrial activity.

The prosperity of the town is reflected in the ceramic wares, especially the painted vessels. The painted motifs were loop, horizontal , peepal leaves, banyan leaves, star pattern, net type, the peepal leaves was dominant painting over this phase II.

A flood of considerable magnitude destroyed the town in phase III and the public houses were and the mud brick wall on which the public houses were greatly damaged. Above the structural remains 60 cm. flood deposit have been marked in several trenches at RGR-1. But no such flood marked in other mound. It imported chart from Rohiri hills upper Krishna region, shell from the Saraswati region. A large number of whet stone made out of stone and hopscotch made out of pottery has been collected from this level.

Period II

A word may be said about the flood which devasted early phases of Rakhigarhi. It was again the three Harappan settled on the flood deposit. But they were also followed the phase III plan. Possible, the Harappan must have prepared town before providing all civic amenities. The neatly laid out platform, street and drains, the provision of public wells the separation of industrial area from the residential localities, the arrangement of houses in the rows clearly suggest careful planning and efficient execution with utmost precision. Execution of public works on so large a scale could not have been possible but for a leader-genius who could enlist the cooperation of the inhabitants and organize and direct the skilled and unskilled labour. As he was hold in high regard he occupied the best mansion having civic amenities and built on the highest platforms so that the seat of authority could appear impressive. This phase has dominated by red ware.

In the RGR-2 a series of large podium has been uneartherned to which two could be identified and related as religious platform are identified yet, because of these platform were partly exposed. A granary having ten number of block for grain storage has been excavated. This granary is made

out of mud brick and thick coating of mud plaster has been in some unearthing wall. Very near to the granary, one market complex has connected both are connecting with lane. The sanitary arrangements were excellent. In the phase VI few house structures have been enearthern in the south-eastern extreme of the RGR-2. These people also followed the same rectangular house plan.

The prosperity of the town is reflected in the exuberance of the Harappan ceramic wares especially the painted vessels of red ware of V and VI phase was dominate 'S' shaped vessels with a hanged rim, cylindrical perforated jars, dish-on-stand, beakers and basins are more numerous in phase V and VI then in phase.

Etched carnelian beads, shell-inlays, ivory dice, bone points and fish hooks, chart blades, cubical weights, shell bangle, steatite beads and artefacts of the mature Harappan culture formed in phases IV, V and VI.

Belief in fire worship at Rakhigarhi evident from podium, where a four fire after in a series have been unearthing and suggest metaphysical aspects of the religion. The conspicuous absence of seals bearing human and semi divine forms and the utter scarcity of mother goddess figures may indicate that certain religious rites which were common in the Indus valley were not popular at Rakhigarhi. In spite of the divergence in ceramics traditions and religious beliefs of the Rakhigarhi folk the overall picture produced by the large assemblage of pots and pans, seals and sealings, tools and weapons, ornaments and toys, buildings and roads in one of amature and prosperous Harappan town. The close cooperation between the original inhabitants and Harappan brought in many benefits to both increased trade with the Indus valley and Sumerian cities resulted in greater material prosperity. The comforts of an urban life were enjoyed that the Harappan played a more dominant role now then they used to do earlier.

The clear change is visible from early to mature Harappan through its material culture the ware surface treatment, making procedure. For example, the grey ware was collected in a good number from lower or early Harappan level where on this grey ware was not found in the mature level.

The surface treatment of the dendritic ware (so called Hakra ware) was totally vanished in the Mature Harappan level. The dendritic ware surface was treated by thin clay with organic material (like bone, wood, shell) applied a thin coating up to neck region in a horizontal above to it applied brown or cream slipped for decorative purpose before to fire it. The changing tradition is noticed in the script and the type of seals used. The very fact that a few square seals of steatite with or without figure but bearing Indus sign occurring period II of phase VI is indicative of the continuity of Harappan traditions.

STRUCTURAL REMAINS

Beyond the Indus period plain, Saraswati-dristvati valley has been constituted the eastern boundaries of the Harappan cultural affinities. A long after the twin city excavation it is the largest site of independent India. The Rakhigarhi fold were making structural architect and maintained the natural elevation of this mound. The Rakhigardian has been constructed heavy public platform (podium) for public performance, heavy fortification wall for protect enemies and avoid wild beast. The burnt brick drainage system, bath platform, water chute has been indicate their highly sanitation and hygienic thought. The well maintained city with gravy, street pattern, podium, fortification wall, house structure and brunt brick bat floor could not have possible without an able and noble guide men. It show the social order, ethics, values of Administration and having a certain cultural affinities which were developed in all corner, on the point of architectural, symbolic sense. The flood marks noticed on the cutting M 5 of RGR-1 city had destroyed once and in the next phase (period II) once again occupied and constructed structure. There is no such remain brought to our light, for water storage and canal system to provide water inside the city. It has indicated that the Drishadvati river system was very much heard to the metropolis. The meticulous engineering construction of huge podium heavy fortification, and house complexes and were reaping in various phases, that is indicate on podium and the fortification wall.

The Harappan folk engineering had developed in its contemporary world, and high architectural skill.

BUILDING MATERIAL

Possibly, the highly planed city was constructed water able guidance of Harappan engineer. The Rakhigarhi people were used, sun dried brick for making their houses structure, than water logged area would have used burnt brick. Very few pieces of stone block have been noticed. These stone pieces were mainly used as weight stone, saddle quern and other domestic purpose. One barrel shaped reddish chunar type sand stone have a hole in centre in its one end, possible used either husk extracting or pudding. Wooden log also used in doorways of on the brunt brick wall yet it could not identified. For building constructed clay mortar have been profusely used.

For construction of the inflammable building the Rakhigarhi folk were used either sundried brick as well as backed brick. The brick are mouded and made out of fine silty clay, kankorise clay and black cotton clay. The moulded brick are very same, common form brick are 28 X 14 X 7 cm., 30 X 15 X 7 ½ cm., 32 X 18 X 9 cm. and 40 X 20 X 10 cm. For drainage system, bath parts from kiln fired bricks are used. Chamfered brick has been used in the drainage system only. The brunt brick bats have been profusely used all around the mound 1 for flooring its thickness is ranging from 10 cm. Some bricks have Harappan signs on it and like modern standard and principal. Except the chamfered brick all other have sharp and strength corner and parallel to apposite side.

The absence of query site within fifty km periphery, they imported stone object from other satellite site and used for domestic purpose. The Rakhigarhi people were utilized heavy stone block as saddle quarn , Bead polisher, some sorts small pieces as what stone sting ball weight stone blade and Bead. The heavy stone block is used as steps on the front of door way, and another sand stone material beautified strength side cubical, squarish chart were used as weight measure system. The hematite nodule, one of

which polished on three side possibly used for cotton weight. And some elongated type red stone pieces suggested their rites ritual.

Today Rakhigarhi has little rain fall area but it was conjugal for throne tree wood is a basic material for domestic purpose and making house door leaves, beams, rafters etc. Some sorts wooden beam imported from outside Rakhigarhi. Due course of excavation one wooden beam exposed in the cultures used as a doorways of a house of mature period, the species is not identified.

Mortar is basic ingredient for construction building and other super structure. Generally, clay mortars used as construction work, but time sand mortar also well known to the people. In a water chute lime sand mortar have been used. Maximum number of remnant have mud mortal element, these an the local have clay, it give more strength to the building. Possibly, the wall plastering was also by clay mixed with other element Gypsum mortar is not used at Rakhigarhi as per excavation suggest, but it was well known to Mohenjo-daro people.

ARCHITECTURE

(A) Floor: - The making process of house floor is varies from house to house, in the basis of utility, but basically mud brick paved floor were well known to the people. In the period I, In the cardinal corner vis-east, west, north and south the 10 to 15 cm. thick brunt brick bats rammed courtyard has been found. This type of floor could not traced else where these floor having circular silos for keeping big strong jar, possible Kankarise clay have also been used for flooring purpose on some house platform in the period II. In respective to wet areas were paved with brunt bricks.

(B) Kiln:- One pottery kiln came to light at Rakhigarhi has cut out as plano-convex plan on pit the outer wall and inner pillar wall is made on brick. The used brick have contain husk, which is yet not identified. The kiln may have covered with simple clay and brick also, because from inside of this chamber fired clay and brick fragment are noticed. The support pillar of centre and the wall both are mud plastered and serve for stone ware

pottery. Inside of the kiln few potsherd fragment have been noticed. The kiln was belong to period II (mature Harappan) and its maximum length and breadth respectively 5 cm. and 2.91 m, fuel it has oblong chamber.

(C) Hearth: - In very house hold have one or two hearth for food processing as well as for other domestic purpose. The hearths are made out of brick and clay paste. Most of the hearths have slightly deep towards it closed side, it should be carries more fuel during tome of processing things. Three type hearth have been noticed there are respectively, Square, triangular and along type. The square type hearths are full with circular and triangular cake, musthica also noticed in few cases. Orientations of these hearths are mostly towards north. Certainly the Rakhigarhi folk had ideas of direction.

(D) Soakage Jar:- For better sanitation Rakhigarhi folk were making Soakage jar, which are found lower town as well as at Acropolis. In the period II phase II maximum number of soakage jar have been marked. The soakage jar were connected with bath or kitchen and embedded in the street close to the mouth of the runners. The soakage jar had hole in the bottom to allow to soggy dirty water, the solid matter would clean periodically. Some time two big jar also placed for waste water.

(E) Stairways:- Brunt Brick pavement and stone slab used in the front of door ways as step (period II) (K5, J5 RGR-I) Brunt brick pivot was used as door socket. On the western side of the podium, where a veranda wall two heavy depression mark have been seen and in short distance a stone slab have circular depression given the idea about door ways, (Q20, Q-21) where as it in the north-south direction there is two short door corner have been seen. It must have used in the earlier period as door ways and later when population was developed the other depressed way used as general public. On a door way decomposed wooden by have been used on brunt brick bats (RGR-2). The wooden log could not identified.

(F) Drainage System :- The Drainage System of Rakhigarhi settlement has through light on their sanitation engineering. The main drain and its connected small drain have maintain on the natural slope. In the period I of RGR-1 (N10, N11, N12) have big drain which is running in the North-South direction and maintain the natural elevation of the mound, but it had used only one course of chamfered brick and trick brunt brick bat paved. In theRGR-2 (M-20) the main Drain having eight to ten courses also maintain North-South flowing. One small *nullah* (S-19) connected with the main drain it has east west from the podium side. Besides these, from Kitchen, bath small tunnel are connected and waste water extracted through the main drain. The main drain carries waste water and flooded water also. No under ground drain system have been come to under our light.

(G) Fortification Wall: - Fortification wall has played a great significant role in the Swarsvati Drusatvati Valley civilization. After meticulous labour of mind and hand on a systematic way. A big fortification wall, its measurement maximum length and max. breadth respectively25x6 m, as per exposed, over the North-Western corner (A16, B13, B14). One veneering wall in the inner side of the main wall, which was also used as path way by the Rakhigarhi folk. The fortification wall gave evidence that it had repaired time to time. The gap between the fortification wall which running from North to south is a street open to west, this is most probably the west-southern gate of the Acropolis. The huge fortification wall suggested there prosperity. At present the maximum lengths & breadth of fortification wall is 25m x 6m.

(H) Fire Altar:- Agni or fire worshipped culture came from the Indus civilization it has evident from various Indus cities. A series of fire alter have been marked at Kalibangan. On the podium four fire alter, at are connected to each them in a series, having squrish, maintain a symmetrical inside it triangular terracotta cake was in seated, fragment of small piece of charred bone also reported from this fire altar, these bones are as step goat, rib, horn and other remain part.

In RGR-1, Yoni-linga style fire altars have been noticed. It is circular and one end having oblong structure and in the centre of the structure, one linga type, which is more hard and most probably made out of kankarise soil and it was destructed during collapse the building. However, its bottom portion has marked.

Another an Antrromorphic fire alter, which is looking like *vastupuresa* type or *chiti* having three opening two small opening side are east and west and the big opening towards south, the North side semi-circular covered with then mud boundaries. In the centre of the fire alter have linga types structure inserted it is made out of Kankarise soil. It is suggested that the Rakhigarhi folk were worshipping fire (Agni) Phallus (Linga) and Yoni. To sum up from these circular yoni type fire alter did not get any bork pieces, only ash and charcoal with few fragment of potsherds.

(I) sacrificial chamber: - Both from the two podium four sacrificial chamber have been noticed. These are ranging small to big, high depth to low depth. The small sacrificial chamber length and breadth respectively 0.65m and 0.45m inside the sacrificial chamber small pieces of animal bone are identified. Another medium size sacrificial chamber has entrain fresh bone of sheep-goat, charcoal potsherd and Terracotta cake. Four sacrificial chambers are located in the cutting S 19, S 20. On the heavy podium two big sacrificial chambers are identified, at a short distance one in the western and another one in southern side. In this sacrificial chamber with a large amount of sheep goat bone, offering dies and small pot fragment, offering charred seeds with charcoal are found. The five altars, sacrificial chamber general public during fair festivals or special occasions.

(J) Street and Lanes: - The Rakhigarhian facilitates by large street and lanes Network from movement public and transportation of Goods, but so far as three street and one lane at RGR-1 and four street at RGR-2 have been traced.

In the RGR-I (G5) the most important among them is street 1 running North South along the house complex and connected with street-2 which is running east-west direction, just in the north-eastern slope, street-3 joint with street-2 making a square and this street is parallel to the street 1. The house complex in which around the three street are running, a industrial workshop having three opening side. In the southern slope of this mound along with drain and home complex a lane has been traced, the drain is following centre of this lane. These streets are rammed with kankarised soil to present water on road, follow the natural slope so water could not storage over this and soaking the excess rainy water and make better for foot ways.

The citadel (RGR-2) area has large network of street and public lane. The period II people follow his predecessor plan and did not change more on city plan. Street-1 s traced in tr. No. S 22 on the south eastern way which is main street of this direction to go lower town probably. Just close to the fortification wall in the inner side one brunt brick paved lane have been traced, which have support the fortification as veneering wall and footpath also. The street-2 which is running north-south direction connected to the podium and market complex maximum length & breadth respectively.

Another street-3 which is running east-west direction and separate the two podium along with a public drain, but there is a exception that the drain is divided the street into two equal past running in the middle. In the eastern side there is enthronement must probably by the later period activity. The street 4 and 5 in the north-south direction and parallel to each other joint with the east-west running street-6 is running parallel to the street-3 at a distance of 100m on the north both of side house complex have been traced.

(K) The Well:- The Rakhigarhi people mainly depend upon the river and channel. Apart from that they dug deep well to avoid scarcity of water. In this master planning of Rakhigarhi two deep well have been traced the first one is just inside the south-eastern gate and second one is at a short

distance of western corner of the triage podium. The well is constructed with brunt brick with mud mortar line. The second well, possibly used for religious purpose and having around the well brunt brick paved platform have been traced.

GENERAL TOWN PLAN OF RGR-1:-

PERIOD – 1

RGR-1, stretching west-east is 6m, high from the surrounding plains and each on the northern extremity of the RGR-3. It is oval in shapes, showing overlapping feature of a twin mound, of which the western portion is higher than the eastern portion and latter merges gently with the surrounding plains towards the eastern side.

The most important feature of the Harappan civilization is the systematic planning of the town, which is noticeable at Rakhigarhi also in the period-I, period-II and its sub phases. The earlier inhabitant of this site made their mud houses on it natural elevated land to prevent Annual flood of the rivers and its tributaries Period-I structural remains have been traced in the cutting L-5, P-11, N-10, N-11, AX-1, X5, Y5 and A5. In the cutting N-10, N-11 and P-11 large area have been exposed to know the period-I city plan, exposed lane along with small drain and both side of the lane mud brick house were build. As per the north-south direction of the lane and drain, houses were build either side. One brunt brick bats remained courtyard having silos ranging from small size to big. After careful floatation could able to get floral remain, but it could not justify what it is? Similar type of rammed floor have noticed in the eastern, North-Western, western slope of the respective trenches A6, AX 9, X-5, Y-5. In the cutting L-5 one mud brick wall of period-I have been traced. The used mud brick ratio respectively 40x20x10 cm and 32x16x8 cm. In the period-I no peripheral wall is marked in any slope of the RGR-1.

Phase – I

In the phase I, few but significant structures have been unearthern during last session. In the cutting R3, K3 circular mud brick structure

could have identified and circular house structure. In K3 cutting only four course of the circular structure has been exposed. The structure facing to words the sunrise. Large number of wattle & dab evidenced also recorded associated with this structure. It suggest that part of wall made by wattle and dab and it roof must be thatched and design into conical. The same circular structure also noticed in the eastern extreme of the mound particularly in the cutting R3- but it was partly exposed. Very near to the circular structure in the same floor level one circular hearth has been exposed in R3 could identified as tandur measured dia 0.92m. The opening was full of ash with charcoal.

Phase – II

Out of three structural phases, the phase II has been studied in greater detail. The drainage system implies the emergence of a planned settlement. A brick lined public drain was noticed running north to south with a house-drain were unpaved. On the eastern side of the public drain was noticed a huge brunt brick bat floor of a courtyard sloping south-west.

Phase – III

Very limited numbers of structure were exposed in the phase-III. Basically few mud brick wall and a small brunt brick but floor exposed in the trench number P-11, R-3 & K-5.

PERIOD-II

In the course of excavation, RGR-1 large numbers of structural remains have been traced. In the length H-5, J-5 and K-5 house complex have been traced; these houses are opening to three side running street-1, street-2 and street-3. The complex-I is identified as lapidary workshop cum residence, have eight room, out of that five for industrial purpose and rest are store room and for General purpose. Inside room No.4 few carnelian core, two fragment of bead polisher few finished and unfinished beads of semiprecious store have been record on the floor level of this room. In the

work, western corner of the room one big hearth, which lost it eastern wing due to later period people activity mainly for the burial pit? However we could able to expose the remaining of the hearth, it is slightly down towards north and having south opening side. One small storing place also identified inside the room, which is made out of single course mud brick with rammed kankarised soil.

Inside the room No. 8 of the lapidary house complex, in a necked eye we could able to get more the two hundred different size of steatite bead on this mud brick rammed floor and adjacent to the eastern wall one squarish hearth has also been exposed.

HOUSE COMPLEX: - 2 In the cuttings of K-5 and partially in the L-5 and J-5, the house complex having ten room and species courtyard opening to the street-I, in the eastern side. Both side of the courtyard these room are planned in systematic manner. The room-4 is not so much big and its length and breadth respectively 2.30m x 2.30m, having two hearth and one anthromorphic fire altar, the squarish hearth is traced along with its eastern wall which is running North-South direction and at a short distance another triangular hearth is full with ash and circular cake kept one above another, in the same room another anthromorphic fire altar have three opening and a cylindrical object in the centre, which is destroyed partly is made out of Kankarised soil suggested Harappan religion.

Another house complex of the period II is traced in the cutting L5 and M5 partially of the western ingredient of the mound. The house complex is right side of the north-south running street-I and opening to western side. As for present cutting L5 and M5 only three rooms and a spacious courtyard have been traced. The house has evident soakage jar along with street. The knowledge of sanitation have shown through a soakage jar which is implement on the out side of courtyard along it small runnel came out from kitchen room.

BEAD FACTORY

The largest structure ever built in phase V is the bead factory situated on the western margin of manual RGR-1 and bound by another house structure phase IV. It consists of few rooms. The rooms two in number seem to have been enclosed by a mud brick wall of the full extent of which is not yet known. It is found to extend into RGR=1 H6, H5, J5 covering on area 20 sq. m. A room floor measuring 2.30m x 2.30m embedded 2000 beads in various stages of manufacturing was found. The main reason for considering the building as a factory of bead workers is that pebbles of agates, hundreds of carnelian beads in various stages of manufacture, rejected cores and flakes were found in a building seeking a kiln in cooking agate pebbles and crushed cornelian beads is situated closely. Thirdly, a flanged drill meant for drilling holes in the beads was found in the same floor. Fourthly, Bead polisher was air embedded in the floor, two sealing, depicted elephant have been collected from this floor that indicate the agate came from distance trade system. It is therefore, reasonable to suppose that a factory of lapidaries engaged in making stone beads was established here.

BEADS KILN

"U" shaped kiln having an opening on the south was laid bare in RGR 1 H5, in close proximity to the working floor. The 16 cm thick 24 cm tall wall the kiln is built of mud bricks and plastered with mud. The kiln was partly damaged by the burial pit of medieval fire, another kiln is good in condition and wall preserved. It is doubtful whether the kiln had any roof at all domed or otherwise. The kiln was used by the bead maker for heating the after and processing it as what exactly the lapidaries of Cambay also do today. The kiln is too small for firing pots and unsuited for other types of firing at high temperature. The kiln was full with ash, mustika and terracotta cakes. These terracotta cakes and mustika, possibly was used or head reservoir and keep heat in constantly. The large number of mustika the adjacent trenches conform the use of the kiln for a long time.

THE BRUNT BRICK BAT FLOOR:-

Out of the Early Harappan three structural phases, the phase II could be studied greater detail. A brunt brick lined public drain was noticed running north to south with a house drain from western side. On the eastern side of the drain huge brunt bricks bat floor was unearthern, it was sloping south-west. There were four circular pits cut in the floor two of bigger size were aligned north-south, while the other two of smaller diameter were aligned east-west. There were few post holes around these pits. The purpose of the floor is yet to be determined. But the sharp gradient in the floor towards the public drain suggests its possible use as textile dyeing solution. An equally wide veranda was noticed in the northern side of the courtyard, which possibly served the purpose of stacking textile.

GENERAL PLAN OF RGR-2

The inhabitants who had built the enormous mud brick platform and granary in the phase-V. The partly North-south running fortification wall of phase-IV reconstructed in phase-V in the north-western extremity of the mound, below to it two circular hearth of period-I, Phase II has also traced. The religious podium of phase-V in cutting Q-19, Q-20, R-19, R-20, S-19, S-20 and other structure were added on both margin of street 1 and the East west running brunt brick drain was added in the same phase, but two other cross walls (north side of the podium) of phase IV remnants of closely related to the podium, one well have been traced. Further west remnants of one drain in.

The existence of lane (lane-) which running north south and joint with the east-west street 1 is indicted by the one side market complex wall another side by granary wall. Parallel to the lane street (street-2) running north south joint with the street 1 in eastern to the podium. One brunt brick drain running in between the podium and middle on the street.

Tow other major remnants, which are traced in the either side of the lane1, are the market complex and Granary (fig) in R22, S20, S21 and S22.

Shopping Arcade:-

In the cutting S20, S21, S22. South to the podium and east to the Lane 1 one market complex has been exposed. Five room are closely related to each other and made in same proportion whereas other two rooms just south of it little bigger in length. Except the room No.3 other have no partition wall within the room. In briefly the room No. 3 is divided two, the outer part length is 3.50m and inner part is 1.40m. The other houses were quite similar and it length-breadth width respectively 5.40m and 2.20m five rooms were opening towards west whereas two room, which were little south to it opening towards North.

Apart from this structure large amount of mature Harappan pottery have been recovered to study great detailed about the pottery form.

Granary:-

A granary has been exposed in the cuttings S-22, T-22, alongwith the lane-1, which is running North- south and turn to east and joined to street-2 (running North-South). The granary plan is roughly 'L' shaped. It has consist of 10 Rectangular. Squarish Block opening from the upper side. North to the Granary one open space has been, it could suggest that the goods carriage.

The granary was made of mud brick of various size in Harappan ratio only 12 course of mud brick has been exposed. The working level of the Granary has embedded with mud brick. The open space area show large number of bullock card wheel mark.

It is greater detailed of the Granary block, the blocks are nomenclature clock wise as 1,2,3….10. Two block No. 10 & 8 are squarish in nature and others varies in size and rectangular in nature. The detailed measurement of block 10 & 8 is 1.10 x 1.10m. The block 2,3,4,5,6,7 & 9 measurement are respectively 1.30 x 1,70m, 1.10 x 1.40m, 1.50x 1.90m, 1.50 x 1.90m, 1.00 x 2.00m, 1.50 x 1.70m, 0.90 x 1.40 m and 1.20 x 1.40m. Due to robust structure, this is not destroyed by the past calamities.

The Podium:-

In the cutting Q-19, Q-20, R-19, R-20, s-19, S-2 Northern side of the street 1, a podium is located the small one is unearthened south to the previous one. The big podium is measured 22m length and 12m width and 13 courses of mud brick has been marked in the western facing wall. The mud brick used in various sizes of Harappan ration like 7x14x28, 7 ½ x 15x30, 8 x16 x 32 etc. In the western part of the podium one veranda embellished with flight of step suggesting entrance from western side. A brick wall was also noticed at the north – western corner. The podium had a street on all the four suggesting its importance in terms of public utility.

Evidence for Religious Podium:-

Fire Alter: - Four fires alter have been exposed on the podium just too North-Eastern extremity in a series to North-South direction. These to south alignment, these were found in a dilapidated condition. The middle of western fine alters had a vertical brick fixed init, symbolizing stump like Yasthi. These fire alter were roughly squarish type and measured as 48 cm. x 50 cm. The partition from one altar to next one is 25 cm.

Apart from this, in the same phase have ample evidence of fire alter, from the mid level of S-22 a coupe of structural units associated with religious purpose. A 'T' shaped fire altar with curve ends, the eastern projection may be taken as working end. Almost the same level of T-23 was reported in a semi circular fashion, recalling those from at Kalibangan. These were found inside the walled floor. Fine brushing over the surface of altars revealed a few circular white patches of possing brunt hard shall of fruits offered at the fire alter. Terraces of mud-bricks at the base of alter suggest that they were specially made ones.

Evidence for Granary:-

A modest Granary was confined in the cutting of S-22 and T-22 it consist to cell on two Segment, with a corridor in from showing built in

bench and a guard cell. The accumulated dust and earth from the cells have yielded barley.

Sacrificial Pit Chamber:-

In the cutting, R-20 has revealed two sacrificial pit chambers on the podiums. Out of three two were located on the big podium where as the other one on the centre of small podium. Mud brick, were used it construction in header & stretcher process. This chamber were naming after exposing one by one; the chamber-I were full of potsherd, mustica fragment, charcoal and bone fragment. The bones were identified as sheep or goat. It measured length and width and depth respectively 1.70 x 1.00 – 0.80m.

The sacrificial pit chamber 2 and 3 were located on the large podium. It was measured 2.40 x 1.50m and 1.80 x 1.20m. This chamber has contained large amount of charcoal and fresh bone.

It could be suggested that the fire altar and sacrificial chamber on the podium, the Rakhigarhi Harappan must worshipped the fire God and sacrifice animal. The same evidence were also reputed from Kalibangan Possible, the eastern Harappan worshipped fire God and sacrifice animal instead of worshipped Mother Goddess, which was popular in Harappan world.

GENERAL PLAN ON RGR – 6

The mound RGR-6, which is located north-eastern of the RGR-2 mound has covered up with season crops. The whole mound has been change into cultivation land during the last green revolution. Because of that few cutting has been made to look for its cultural deposit and correlate with other mounds. During the three year excavation only three trenches have been excavated on the centre of the mound and it is provide a panorama view of the Harappan settlement. The little expose gave a good

network of street and lane, and either side of the lane a number of houses were expected as compare to our planned city.

The whole mound is covered with early Harappan remnants. The M-12, M-13 and part of M-11 has been evident five phases of structural deposit with god quantity of early Harappan pottery.

In the phases-I A semicircular deep garbage pit has been exposed without any house structure. The pit was containing large quantity of early Harappan pottery, antiquity, mainly bone point, graffiti or inscribed potsherd and other minor antiquity. In the phase-II one circular house (2) has been partly exposed, its diameter is 2m. The door of the house was opening towards south. The brick were used as stretcher process only inside of it simple clay has been rammed to Harappan the floor. The same circular type house has also been unearthen at RGR-1 in the early level. Kunal early Harappan site has noticed the same circular house structure. In the phase-II no other structure is exposed. In the phase-III a north-south running wall (3a) has been exposed below the east-west running wall of phase-IV. The north south mud brick wall (3a) joined with a long east-west brick wall (3b).

The phase-V of RGR-6 give a clear picture of planning settlement of early Harappan folk. It has also a good network of street and lane. The house complex (7) has comprise of seven rooms all the houses opening towards the lanes and street, so it conclude that the house complex used as market complex in the early Harappan phase-V.

The existence of a lane (lane no.-1) parallel to lane-2 which is running north-south and bisect by a east-west running street with measure 0.90m. The house complex one has comprised of seven rooms. The room-1 to room-4 opening towards the lane-1 in front of it another house complex which is very little exposed and towards the same lane-1. The room-5 to room-7 opening to the east-west running street (street-1) . The room-3 and room-6 has evident a circular type hearth, a triangular hearth respectively show the working activity. The minimum size of the room is measured 2.30m x

2.30m and max. is 2.80m x 2.40m in the room 2,3 and room-5 and 6 respectively. The room-7 is bigger in size and measured 3.50 x 2.90m.

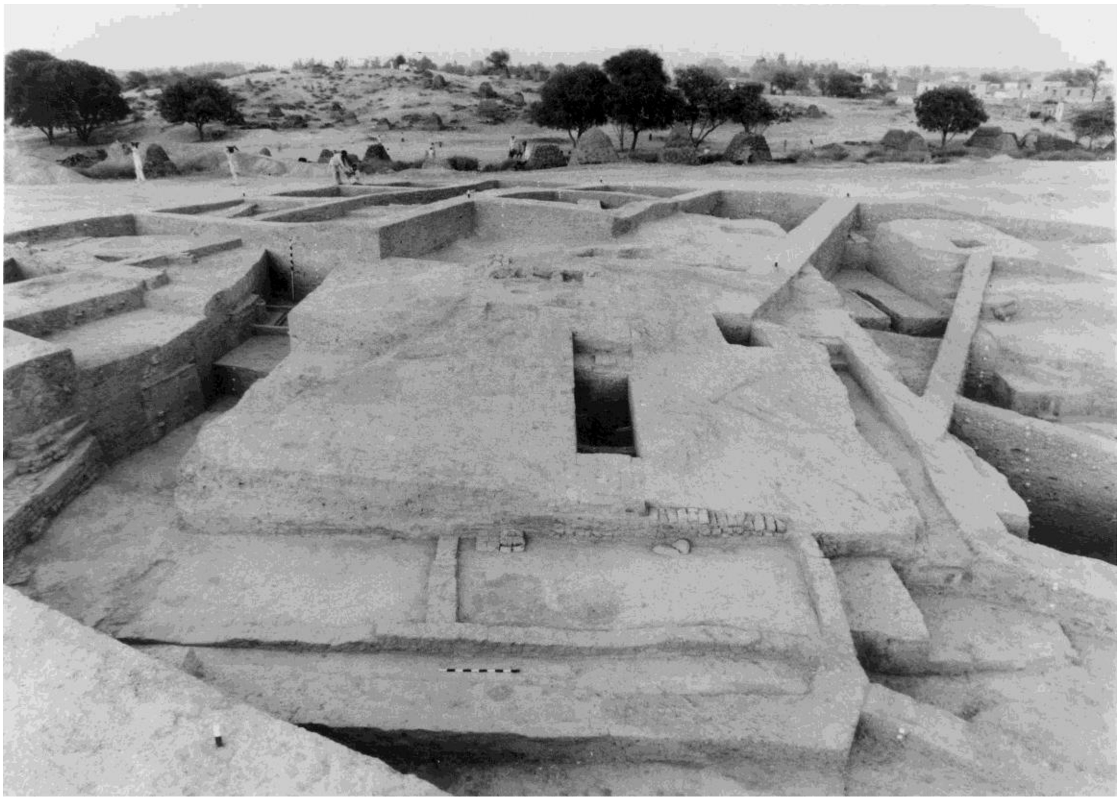
After the above all description it is showing that the circular hut had also used by the Harappan folk. It was evident from other Harappan site of eastern boundary of it like the Kunal. A circular type houses were very common in the Deccan Chalcolithic.



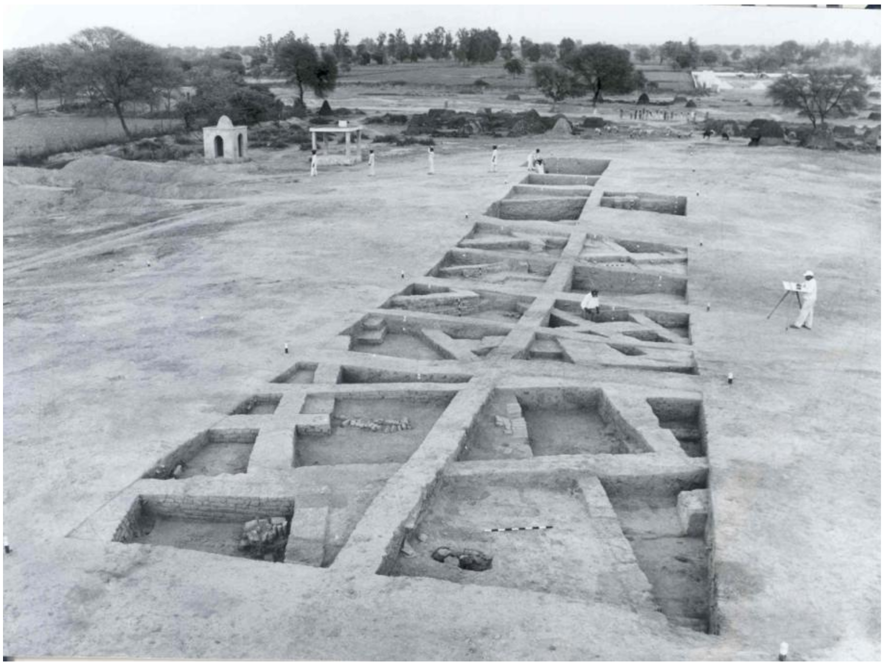
Pl.4.1 Structures from RGR-6, Early Harappan Period



Pl.4.2 Structures from RGR-1, Early Harappan Period



4.3 Platform for dying cloths, Mature Harappan period



4.4 Structures from RGR-1, Mature Harappan Period



4.5 general view of the Cemetery Area, RGR-7



4.6 Burial number 1, RGR-7, Mature Harappan Period.

Chapter 6
Burials

Introduction

The excavations at Rakhigarhi (29^{o} 17’ 30” N and 76^{0} 06’ 50” E) have reported skeletal series of the Harappans both from cemetery and habitation area. The interment archaeology is quite unique as it unfolds a distinct funerary mechanism for male and female sex, besides other mortuary features commonly recorded at Kalibangan and Farmana.

Useful archaeological data on human burials of the Mesolithic and Neolithic periods gathered at sites located in the Ganga plain and in the piedmonts of the Vindhyas and the Aravallis serve as antecedents to the Harappan mortuary practice. Number of data tabulated from these prehistoric sites is of primary inhumation of extended variety with few exceptions of flexed and double burials. Some of these graves are bereft of offerings while in some limited presence is marked. The convention of offerings becomes a mandatory affair with the rise of Harappans when the belief of life after death gains currency. At this point of time disposal of dead became an elaborate practice where in appropriate modes were devised for various segments of the social hierarchy. Noted ones are (i) primary interment either interred in supine or flexed position (ii) fractional (iii) cremation and (iv) disposal in cinerary urn or ossuary. Suitably, these types of disposal of dead together with nature of offerings, orientation of inter of corpse, location of burials etc. find reference in the Vedic and later Vedic texts. While analysing archaeology of burials at Rakhigarhi, attempts have been made to substantiate the evidence with that of the traditional accounts.

Emerging Perspective

Adequate evidence on the funerary rituals of the Harappans collated from traditionally vibrant interfluves of Saraswati and Drishadvati at sites like Kalibanga (Sharma 1999), Farmana (Shinde *et al.* 2008: 64-78) and Rakhigarhi (Nath 1998; 2001) and limited notice from Tarkhanewala Dera (Ghosh 1962 M. Anth. I, 9), Rupar (*IAR 1954-55*:9; Sharma 1956:123) and Chandigarh (*IAR 1970-71*:7; Gupta 1972: 59-60) are of vital importance. Its

survival of in the late Harappan context at site like Bhagwanpura (Joshi 1993:19), Sanauli (Sharma *et al.* 2007), Bedwa (Kumar 2006:196-204) Puthi Seman and Bhorgarh (Babu 1994:89) suggest continuance of inherent belief system of life after death.

Majority of these sites have shown preference for primary interment in rectangular pits with an exception of cremation platform at Tarkhanewala Dera (Ghosh 1952) and cinerarium at Kalibangan (Sharma 1999). Isolated occurrences of cinerary urns have been noticed in the habitation area of RGR-2 at Rakhigarhi. Another interesting feature is entombment of deceased in a corbelled chamber noticed at sites like Mehargarh (Jarrige *et al.* 1979) and Rakhigarhi (Nath 1998), however mud brick lined grave-pit chambers have been exposed at Nal (Hargreaves 1929:26-27 pl. XV-e), Kalibangan (Sharma 1999;65-74), Lothal (Rao 1979), Dholavira (Bisht 2012, in print), Rupar (Gupta 1972:67), Daimabad (Sali 1986:175 pl. LIII) and Sanauli (Prabhakar 2012:612 fig. 6.10). Instances of formal and aberrant inhumations from habitation area have come to light at Harappa (Kennedy 1994) and Dholavira (Bisht 2012). Rakhigarhi has yielded evidence of entombed burials from the habitation of RGR-1 (Nath 1998) and irreverent ones of traumatic nature from RGR-2.

Archaeological context

Archaeological residue at Rakhigarhi (29^0 17’ 30” N and 76^0 06’ 50” E) spreads over in area of 3 Km radius (300 hectare) encompassing a set of seven mounds out of which 1 to 5 are integrated while a couple removed from each other. These are interspersed between two palaeo channels which were tributaries of the Drishdavati, currently known as Masudpur distributaries and Lohari Minor flowing in the northern and southern surroundings respectively. Compared to rich archaeological potential, the excavations at this site were limited to three field seasons, primarily to impart field training to the trainees of the Institute of Archaeology, New Delhi.

Broadly, the habitation deposit consists of two cultural periods, namely early Harappan (Period I) and mature Harappan (Period II). Period I has further been classified in to two sub-periods namely pre-formative

(Period I A) and formative (Period I B). Out of these two sub-periods, Period I A noticed in a limited excavation at RGR-6 is represented by three phases of structural activities. Phase (i) is marked a thick mass of mud platform and pottery types of Plain Red Ware and Chocolate Slipped Ware largely turned on slow wheel with certain exceptions of handmade. Phase (ii) is identified with a circular structure made of wedge-shaped mud bricks and rectangular structure. The ceramic industry introduces paintings and typical surface treatment in the form of appliqué and rustication. Phase (iii) is distinguished by rectangular structures dispensing with circular ones and further experimenting with the ceramic industry of the preceding phase while introducing a new pottery type in grey ware. The calibrated radiometric dates range from 6420 ± 110 to 6230 ± 320 (Yrs BP). Period (I B) is characterized by organized settlement where in structures were laid parallel to streets running at right angle, besides developing the concept of public drainage system. Other cultural traits included copper objects, terracotta bull figuring, toy cart frame, shell bangle, chert blades, steatites etc. The early Harappan culture through these stages was relatively moderate but progressing well towards its maturity. The calibrated radio metric dates range from 5910 ± 130 to 5230 ± 60 (Yrs BP). In the successive phases of occupation at the site and its surrounding witnessed large scale expansion of the inhabitants and marked change in the life style gave rise to the mature Harappan stage (Period II). During this period the early Harappan occupation at RGR-6 comes to an end while their contemporaries at RGR-1 and RGR-2 further evolved and intensified the process of urbanisation. The results obtained from the excavations indicate subsistence economy of mixed type wherein agro-pastoral needs were prioritised by cultivating two crops *rabi* and *kharif* besides domestication of animals. The evidence of specialized crafts based on rocks and minerals and organic materials catered the requirements of internal and overseas trade. The calibrated radiometric dates range from 4560 ± 90 to 4320 ± 90 (Yrs BP).

Apart from formal interments in the cemetery area, the site has reported evidence of primary burials from the habitation area of RGR-1 and RGR-2. These have been discussed separately and numbered serially mound

wise. Apart from primary burials, RGR-2 has recorded secondary nature of disposal in cinerary urn or ossuary.

Location of Cemetery

Selection of cemetery site in relation to Harappan settlement deserves explanation as locations documented in the context of habitations hardly evoke any pattern. For example the location of cemetery at Surkotada (Kachchh) and Rakhigarhi (Haryana) is to the north of habitation. But at Dholavira (Kachchh), Lothal (Gujarat) and Rupar (Punjab) it is situated to the west of habitation. Similarly, cemeteries located in the Sarswati-Drisdavati Valley hardly show adherence to any set norm. At Kalibangan it is located to the west-southwest and at Farmana to the north-west. At sites like Sanuali, Bedwa, Puthi Seman and Bhorgarh the context of habitation remains to be ascertained.

Likewise, distance of cemetery from habitation hardly elicits any set practice. On an average the gap between cemetery and habitation ranges from 200 m to 300 m with certain exceptions noted at Farmana i.e. 900 m and Rupar 49 m. At Rakhigarhi it is located 750 m north of RGR-2 and 300 m north-east of RGR-1. Evidently, the distance and direction of location of cemetery in relation to habitation seems to have been influenced by local geographical initiative rather than any set regulation. As a result of geographical constrains as well as ritualistic obligations, majority of cemetery sites have been found located adjacent to watercourse or river front. Circumstantial evidence of age old tradition of ceremonial ablution of the deceased possibly warranted the Harappans in locating the cemetery in the surroundings of water body. Advantageously, the *Satapatha Brahmana* prescribes that the cemetery be located out of sight of the village and burial be made on salt free soil, over a level ground, closed to woods, where the waters flowing from a southerly direction come to the east and stand still without dashing forward (Kane 1953:231-33). The above literary account, to a certain extent, is compatible with the geo-morphological residue available in the surroundings of the cemetery area identified as RGR-7. Here, the burial ground, located on elevated plain, is composed of silt laden bed of yellowish sediment. The quality of preservation of the skeletal remains

indicates that the soil was free from salt content, which is further attested by the existence of a well of sweet water close to the burial ground. To its immediate south lies palaeo-channel meandering to the east, besides gallery forests in its suburb. Further, the location of cemetery at a distance of 750 m from habitation is an out of sight spot amid gallery forest corroborates literary reference. (fig.1).

The Cemetery

The discovery of cemetery at Rakhigarhi was a result of a concerted effort undertaken in the northern extension of the village. The clue to its location was shared by the villagers that some human bones and pots were encountered when a well was dug for irrigation at the behest of master Balbir, the land owner. He was taken into confidence, who in turn spared a piece of land for archaeological pursuit on the eastern margin of the well where surprisingly the stem of a broken dish on stand was seen embedded in situ, which subsequently turned out to be part of a grave furniture of burial no.1. Owing to mechanised ploughing of the field it is expected of erosion of upper surface which is likely to have caused irreparable damage to other burials of upper phase.

On confirmation of existence of a Harappan cemetery a grid of 10 m X 10 m numbered as R 20 was laid incorporating the dish on stand in the cutting. In the event of limitation of opening more than one grid, the extent of cemetery area could not be ascertained. However, the nature and content of soil of the cutting spreads over an area of 100 m square. The grid subjected to excavation has yielded a cluster of eleven burials laid north-south. The burials have been numbered serially in a sequence of their exposition; it has no reflection on the chronology of disposition. Out of eleven findings, skeletal remains of extended interment have been located in the burial number 1,2,3,4,6,7,8 and 11; the remaining three burial numbers 5, 9 and 10 contained residue of dislodged bones and pots in which the grave-pit lines were eroded due to sheet-flooding and agricultural operations. Resultantly, the burials with poor soil-covering of less than 10 to 15 cm have suffered most.

The stratification in the cemetery underlines three phases of interment attributed to mature Harappan period. This could be determined on the basis of depth of grave-pit and its sealing layer, besides the damage caused to the corporeal remains by a later grave-pit activity. Further, as a result of periodical erosion over a period of time the hemispherical heap of earth over the grave-pits has eroded and regular ploughing has caused irreparable loss to the upper layers of the deposit, hence at times it is difficult to distinguish sealing layers. Nevertheless, the burial no. 11 is attributed to phase A on the basis of relative mineralization of the bones as compared to the bones of other skeletal remains. Burial number 1 and 6 have been disturbed by later grave-pits of burial number 4 and 7 hence former set of burials are assigned to phase B and the latter ones phase C.

Field Observations

The first stage of surface clearance within the operation area revealed a few dislodged grave goods like stone muller, terracotta hopscotch and a couple of beads-one each of steatite and faience. The process of excavations further spotted sporadic remains of bones of cattle and goat or sheep in misplaced context. These bones were part of offerings for deceased which got displaced due to erosion or human activity. Bones of cattle have earlier been discussed in the context of burials at Dam Buthi and those of sheep and goat at Nal (Hargreaves 1929). Offering of a goat with the deceased finds reference in a hymn addressed to *Agni* in the *Rigveda.* The goat has been regarded as a path-finder to the deceased (Rao 1978:143). Similarly, the *Atharvaveda* presumably refers to a draft-ox for the dead to ride in the next world (Rao 1978: 142; *AV.* 31. 8; XI. 18).

The grave goods largely consist of earthen wares, whereas personal ornaments like necklace of steatite beads, shell bangles, miniature fillet of gold and beads of gold are in short supply. Conspicuously, the selection of earthen wares and their arrangement in the grave-pit postulates a pattern in the interment practice with regard to disposal of deceased of male and female sex. The types of vessels in red ware are dish-on-stand, bowl-on-stand, goblet, beaker, medium and small sized vases with globular body and low neck, convex sided bowl, basin and dishes. Composition of such type of

vessels is quite akin to earthen wares found in the burials at Kalibangan (Sharma) and Farmana (Shinde) located in the Sarswati-Drisdavati Valley. But at these sites no such distinctions have been noticed with regard to offering of particular type of vessels to male and female sex. At Rakhigarhi the burials of male and female followed a particular type of funerary pattern in respect of male and female sex. The female deceased were offered more than double number of earthen wares as compared to opposite sex. Apart from this, the female deceased were invariably offered dish-on-stand, bowl-on-stand, beaker, and medium sized vases, denoting their status over and above male counterpart.

Offering of earthen utensils is part of funerary rights as mentioned in the *Atharveda* (*AV.* VIII. 4.16-30). There are verses which invoke *Agni* to protect offerings like cakes made of flour of rice or wheat cooked in *ghee* (clarified butter) placed in covered earthen vessels. Other eatables soaked in milk, curds, honey and juices, grains and sesame seeds soaked in water and heated in pans for safe passage through the nether world. The types of pots offered to these graves had a function to hold grains and other eatables as enumerated in the Vedic sources. Functions of utensils like globular vases for keeping cereal, basin for cooking or soaking for grains, goblet and miniature pots for curd, honey and juices and beaker for serving liquids, dish-on-stand and bowl-on-stand were useful table wares.

Burial wise Skeletal Inventory of the Cemetery Area

RGR-7 Burial no. 1

The most exclusive burial in the whole collection unearthed in R20/1-(b) with all typical burial goods. The pit of grave is of oval shape with dimension of 163x83x84 cm.

The general orientation of the burial is north-west to south-east and the skull is raised and tilted towards west. There are 21 pots arranged near the skull and right humerus. The earthen wares arranged in semicircular order, partially disturbed, includes vases, small jars with a low neck and bulbous body, the convex sided bowls, dish, basin, goblet, beaker and above all a dish-on-stand. Among antiquities, there is a shell bangles seen in the lower left arm and a miniature gold armlet reminiscent to fillet has been

found placed within a circular clay formation near the right humerus. Apart from these couple of gold and stone beads has also been recovered. As per the Vedic accounts, the married women were allowed to put on ornaments as part of burial rituals hence it may be considered that the present diseased was married and her husband was alive at the time of her demise.

The skeleton is well preserved in good condition. The general description of skeleton is given below. This adult female specimen is represented by complete skull and other post-cranial bones. Axial skeleton and upper extremities are well preserved. Pelvic girdle and thigh bones are also complete except for the damage to the distal end of femur. Portion below knee is lost by the later pit activity to accommodate burial no. 4. The available length of burial pit is 190 cm, width 90 cm and depth 63 cm. The base of pit has a gentle slope from north to south.

Skull is complete and well preserved. Entire facial skeleton is in articulation.

This female is fairly robust in built. Supra-orbital region and glabella are fairly pronounced. Temporal lines are prominent and extend up to parietals. Mastoids are moderately built. Face is straight and the metopic region is slightly sloping, chin is prominent and mouth agape.

Some damage has been occurred to the neuro-cranium. There is a diagonal crack along the left parietal and a horizontal crack on the occipital. There are some erosion marks on the right parietal. Intra-orbital region of the left maxilla also show some bone erosion.

The description of skeleton is given below:

Skull :	It is complete and intact.
Mandible :	Slightly articulated.
Dentition :	30 teeth, 15 in upper Jaw and 15 in mandible. All teeth are intact, showing heavy grinding marks.
Clavicle :	Placed at right position and intact.
Sternum :	Partly damaged and articulated towards right side.
Ribs :	Nine pair, all are at right position but partly damaged.
Scapula :	Both scapulas are in good condition and at right position.
Humours :	Both humours are at right position but have developed some cracks.

Radius : Both radius are in good condition.

Ulna : Left Ulna is visible and in good condition.

Vertebra: Vertebra is placed at right position but badly weathered.

Pelvic : Developed cracks, thus not in good condition .

Femur : It is in good condition but cut from the distal end due to the grave-pit activity of Burial no.4.

Some in situ measurements taken at the site are as under:

Bizygomatic breadth				121
Nasal height				52
Nasal breadth				-22
Upper facial height				70
Sub-nasal height				20
Bimaxillary breadth				96
Orbital breadth	R	39	L	40
Orbital height	R	32	L	30
Chin height				37
Gonion-gnathion diameter				91
Min. breadth of ascending ramus		32	(left)	
Mandibular height				-62
Minimum frontal diameter		96	(left)	9
Max. cranial length				-186

The individual is adult, but the third molars are not erupted except the right mandibular third.

Some long bones are exposed fully and permit measurement of length dimension,

Humours	R	28.5	L	28.5
Radius	R	22.5	L	22
Femur	R	-	L	-40
Clavicle	R	-	L	-13.5

The estimated stature of this individual is 155 cm. The sciatic notch is preserved completely for both sides which confirm the female sex of this specimen.

RGR-7 Burial no. 2

This burial is one of the stoutest and the tallest burial having less number of pottery and its skull is damaged due to static pressure. The oval pit is cut through the layer 1. The dimension of the pit is 230x 80x 70 cm

and the general orientation of burial is north-west to south east and skull is raised and tilted towards west. The pit has slope from north to south. The lower portion of legs has gradually been placed close to each other. The burial is devoid of antiquity. Three red ware vessels of medium and small size and a shallow bowl are found near the skull.

All the skeletal elements of this adult male are present but in extremely fragmentary and weathered condition. Longitudinal cracks have developed along the long bones. Heavy encrustation of matrix and salinity will preclude morphological observations in the laboratory.

Description of bones is given below:

Skull :	It is damaged from parietal and frontal bones due to static pressure.
Mandible :	It is fairly intact.
Dentition :	All 32 are present but 2 is missing may be due to age.
Clavicle:	Both of them are intact.
Sternum :	It is articulated towards left.
Vertebra :	All vertebra is intact and placed at right place.
Ribs :	16 ribs are visible all are in good condition.
Humours :	Left Humours is damaged from distal end but right humours is fairly in good condition.
Radius :	Left radius is damaged from the distal end and right radius is intact.
Ulna :	Both Ulna is intact.
Pelvic :	It is having cracks and damaged from left.
Femur :	Both the Femur is intact and having muscular ridge.
Tibia and Fibula :	Both are intact and having muscular ridge on it.

Neurocranium is severely damaged. Though many of the bones are present, reconstruction may not be possible as margins are eroded. Facial skeleton and the frontal bone are, however, complete and in fairly good state of preservation. Extreme robusticity of the glabellar region is the most noteworthy feature. Face appears to be straight. But slight alveolar

prognathism is evident. Mandibular dentition is complete on the left side, and possibly for the right side too (Right half was not fully exposed at the time of visit to site). Maxillary dentition, however, matters loss of few teeth. Right canine was found loose, which is fixed in its position. Left canine and second pre molar are lost. The loss of canine appears to be post-mortem as the socket is open. No comment can be made at this stage for the loss of second premolar. For the third molar presence, observations can be made only for the left side of mandible and in this case the tooth is not erupted.

Some measurements are possible on skull in cm:

Orbital breadth	R	–	40	L	–	40
Orbital height	R	–	32	L	–	30
Nasal length						51
Nasal breadth						23
Sub-nasal height						22
Upper facial height						72
Bi-maxillary breadth						107
Gnathion Gonion length						94
Chin height						-32

Minimum breadth of ascending ramus is 32 cm.

Of the post-cranial skeleton, lower part of thoracic cage is damaged. Distal half of the right hum is broken & missing. Right ulna is also broken distally. Hand and foot skeletons are complete but for the loss of same phalangeal bones. Long bone measurements are as follows.

Humerus	R	-	L	32.5	cm
Radius	R	25.5	L	25	,,
Ulna	R	-	L	26.5	,,
Femur	R	-44.5	L	45	,,
Tibia	R	37.5	L	37.5	,,
Fibula	R	37.5	L	-36	,,

Estimated stature of this individual is 171.00 cm, who could have survived more than 60 years.

Femur is very robust, so also the deltoid region of humerus.

Robusticity of long bones and that of the glabellar region suggest male sex of the specimen, which is confirmed from the narrow sciatic notch (preserved completely for both sides).

RGR-7 Burial no. 3

The oval pit is cut in layer 2. The dimension of pit is 230x70x70 cm. The general orientation of female burial is north-west to south-east and interestingly the upper half of the grave was given packing of potsherds along the pit line. Top portion of burial pots is chopped by furrow of cultivator and so are the right parietal and frontal bones. The rest of the skeletal remains are in fairly good condition and it is a perfect example of an extended inhumation placed in supine position with legs apart. The head is tilted towards south-east and looking downwards. The number of pots arranged behind the skull is six and another is placed to the south of left leg. The female burial, however, is free from ornament, thus indicating her burial rites as that of a widow.

This moderately built female is represented by complete set of bones. But for the post-mortem loss of lower phalanges and right fifth metatarsal, right knee cap, all other post cranial elements are present. The skull, however, suffers serious loss at frontal and parietal region.

Description of Skeleton:

Skull : It is damaged from left partial and frontal rest of the parts are in good condition of preservation.

Mandible : Slightly articulated but in good condition.

Dentition : All 32 teeth but one molar (last) is missing from upper jaw.

Sacrum: It is articulated towards the right but in good condition.

Scapula: Both scapulas are at right position and intact.

Clavicle: Articulated but developed cracks.

Vertebra : All vertebra is intact and in good condition.

Pelvic : It is well intact and complete.

Humours : Both the humours are intact and pressured.

Radius : Right radius is placed medially and left is laterally in good condition.

Ulna : Right Ulna is placed laterally and left is medially.

Femur : Left Femur is damaged from distal end but right is fairly in better condition.

Tibia : Both are complete.

Fibula : Both are seen in entirety.

Ribs : 20 Ribs are present and rest are either missing or hidden under the soil.

The skull is moderately built. The self supra-orbital region, the left temporal lines are not so pronounced as they are in other male specimens of this skeletal series. A few possible skull measurements are as under:

Orbital breadth	R	40	L	35
Orbital height	R	30	L	33

The discrepancy in measurements in the right and left side of orbit is observed because of the damage that has occurred to the right eye.

Upper facial height	65
Nasal height	45
Nasal breadth	25
Sub-nasal height	20
Bimaxillary breadth	95
Chin height	26
Gnathion-gonion length	85
height of mandible	-60
Minmum breadth ascending ramus	36
Breadth of bizygomatic arch	- 118

No measurement on neurocranium is possible.

All teeth are preserved and are in situ right. Mandibular arcade is complete with the third molar. Maxillary third molar is not erupted.

Good amount of metric data is possible on long bones.

Humerus	R	29.5	L	29.5
Radius	R	23.5	L	-23
Ulna		25		25.5
clavide`		14.5		-
Femur		45.5		45.5

Tibia		-37		-37
Fibula		-		-34.5

The estimated stature is 164.00 cm. Left sciatic notch is visible and suggests female sex of the individual.

RGR-7 Burial no. 4

This burial is less ornate but in good state of preservation. The oval pit is cut in layer 3 has disturbed the southern portion of skeletal remains of burial no. 1. The pit is cut through layer 2 having a dimension of 235x70x40 cm. The general orientation is north-west to south-east. There is a mud brick appendage near the left margin of upper arm of the skeleton. The head is raised and tilted towards the south-east, looking downwards. It is another complete example of an extended burial where in the skeleton is laid in supine position with legs apart. The earthen wares are arranged behind the skull consist of two vases and a beaker and a dish. The burial is free from antiquity.

This male adult is represented by complete skeleton. Damage has resulted in the loss of distal halt of right femur, patella and some part of tibia head. Also lower meta-bones are missing, Except for a few tarsal bones.

Skull is complete. A longitudinal crack which runs through the frontal and the sagittal suture has resulted in superimposition of the left neurocranium over the right half. Facial skeleton is also slightly disturbed towards right side and its alignment is also lost.

Description of Skeleton:

Skull : Skull is fully in good condition slightly articulated.

Mandible : Mandible is articulated complete in itself.

Dentition : All 32 teeth are present but one front molar from lower jaw or mandible, second premolar from upper jaw are absent.

Sternum : Sternum is articulated towards right, it has developed cracks and pits in the surface.

Clavicle: Placed at right place, but right clavicle has cracked.

Scapula:	Placed at right place, but body scapula is damaged.
Rib :	Nine pairs of ribs are present but not in good condition.
Vertebra :	All 24 Vertebra are present at right place. Thoracic vertebra has developed cracks.
Pelvic Girdle:	Pelvic Girdle is partly damaged with cracks and pits.
Humours :	Humours is fairly in good condition and placed at right *place*.
Radius :	Both right and left radius is placed medially and in good condition of preservation.
Ulna :	Both ulna placed laterally and in good condition.
Upper Digits:	All intact and placed in a good condition.

The specimen appears to be moderately robust. The gonium region of mandible and mastoids are prominent. Temporal line, supra-orbital as well as the glabellar region is, however, not markedly developed. A few measurements are taken for record sake, which are to be confirmed in the laboratory after reconstructing the specimen.

Max. cranial length	-182
Upper facial height	70
Nasal height	54
Sub-nasal height	14
Nasal breadth	21
Chin height	27
Gnathion gonion	91
Minimum breadth asc-	26
height of arc ramus	63

Right side dentition is fully exposed. The maxillary first molar and the mandibular second molar are absent. The respective tooth sockets appear to be completely (or partially) obliterated which indicate loss of these teeth before the death of this individual. Anterior teeth of the left side are present but the molar area is not visible as yet. The right side third molar is fully erupted and is in occlusal plane.

The post-cranial skeleton is much better preserved except for the loss of some bone in the right knee region. The bones are robust.

Clavicle	R	14.5	L	14.5
Humeru		33		32
Radius		23.7		23.8
Ulna		-27		-27
Femur		–		46
Tibia		-		38

Estimated stature is 172. 00 cm

Sciatic notch is male-like, the judgment can be supplemented on the basis of robustly expression.

RGR-7 Burial no. 5

The burial has been damaged by the furrow of cultivator beyond repair. However, few fragmentary bones of legs could be retrieved along with earthen wares as grave furniture. The orientation of burial pit could be traced in north-west to south-east direction which measured 200x90x20 cm. Eight number of red ware pots bearing patination have been found in damaged condition towards the northern portion of the grave-pit includes vases, beaker, and goblet, dish and miniature pots.

Description of bones is as under:

Femur: Right femur is having cut from centre up to the distal end and missing. Left is fairly in good condition.

Patella : Right patella is missing but left patella is at right place and in good condition.

Tibia : Left tibia is damaged from upper proximal end. Right is fairly in good condition.

Fibula : Right fibula is not visible but left fibula placed laterally but damaged.

Lower extremities: Both the digits of right and left are missing except tarsal of right is present, rest is missing.

Keeping in view the brawny leg bones, the sex of this individual may be considered as that of a male adult and the proximate age could be between 45 to 50 years.

RGR-7 Burial no. 6

One of the exclusive burials with elaborate grave goods was inadvertently destroyed by the diggers of burial no.7. Resultantly, the lower portion of mandible atlas and whole body is now missing except left tibia-trabecula and metatarsal which is partly preserved in the section facing west of burial pit no.7. The pit is oriented in north-south direction wherein the head is laid to the north over a raised surface which is slightly tilted towards east. The earthen wares eleven in number are arranged along the head in the north which consist of basin, vases, beaker, goblet and dish-on-stand. The basin is placed upside down covering miniature vases. The overhanging basin in the section across the burial pit shows a careful arrangement of grave goods as part of funerary rituals accorded to the deceased. It also indicates that special care was taken in the course of filling up of the pit as a number of earthen wares have been found intact. Careful heaping up of earth over the corporal remains had certain ritualistic overtones which reminds the hymns of the Rigveda (*RV* X.18.11) which backs cautious filling of burial pit.

उच्छ्वञ्चस्व पृथिवि मा नि बाधथाः सूपायनास्मै भव सूपवञ्चना ।
माता पुत्रं यथा सिचाभ्येनं भूम ऊर्णुहि ॥ 11 ॥

'Earth, rise up above him; oppress him not; be attentive to him (and) comfortable; cover him up, earth, as a mother covers her child with the skirt of her garment.'

The available dimension of burial pit is 65x105x92 cm.

Description of skeletal remains:

Skull : Skull is good condition and preservation with few fracture.

Mandible : Mandible is badly damaged and cut from the ramous.

Dentition : Upper jaw dentition are complete and intact. Lower jaw dentition only molar and last pre molar of right is remaining. Rest is missing.

Vertebra : Only atlas and axis are survived but in dilapidated condition.

Tibia : Left Tibia as remain but damaged badly from primal condition.

Digits : Few partly preserved in articulated position.

Here, the pottery assemblage is well preserved under a basin which is kept upside down over vases, unlike burial no.1 where it is placed in normal way containing a dish and two jars. A few miniature pots, beaker and lower portion of dish-on-stand also form part of grave furniture. The interment rituals with regard to the selection of earthen wares appear to be identical with that of the burial no. 1 which was associated with the rituals of a married woman. Hence it may not be out of place to suggest that burial no. 6 may as well belong to a female.

Skull is complete, except the left half of mandible. Right 37 gomatic area is broken and some damage has occurred to the intra-orbital region on both sides. Skull is moderately built. Face is straight with slight alveolar prognathism. Supra orbital region, mastoids and temporal lines are prominent. Skull is not yet fully exposed along the left side.

Orbital breadth	R	34
Orbital height	R	32
upper facial height		65
Nasal height		50
sub-nasal height		16

All maxillary teeth are present but for the left lateral incisor. The RM3 is much smaller in size and half erupted. Mandible is broken, entire left side and portion anterior to RM1 is absent. Third molar of right side is present in situ. Left tibia and fibula are broken proximately.

RGR-7 Burial no. 7

The Burial no.7 is an elaborate one attributed to a female which is at par with in funerary rituals noted in case of other female interments at this cemetery site. Currently this specimen is on display in the National Museum, New Delhi. It is an extended burial oriented north-south. The pit is uniformly deep with a slope from north to south. The base of the pit is

neatly plastered with lime-like substance. The head, slightly raised with mouth agape, placed in the north and tilted to south-west. Rest of the portion of skeleton lay in the slope in supine position; left hand and both the legs are in prone. The upper left arm is broken whereas the corresponding wrist possesses pair of shell bangles. In all there are eleven earthen wares kept behind the head which include vase, goblet with pedestal base, low necked jars, bowl-on- stand and dish-on-stand. Composition of earthen wares together with dish-on-stand is typical to the funerary rites pertaining to the females noted at this cemetery.

The Description of skeletons remains:

Skull : Skull is well preserved and intact.

Mandible : Slightly articulated and well preserved.

Dentition : All 32 teeth are intact but first and second premolar of left in the mandible is missing and second incisor in upper jaw is missing.

Clavicle: Both the clavicle is articulated but in good condition and lateral end of right clavicle is laying below the maxilla.

Scapula: Scapula is fairly in good condition and in good position.

Humours : Right humours is well preserved but left is broken in two pieces from the proximal half.

Radius : Both the radius are fairly in good condition and placed medially.

Ulna : Ulan is fairly good condition and laterally digits, both right and left digits placed laterally and in good condition.

Sternum : Sternum is articulated towards right and in two pieces.

Ribs : 11 pairs of ribs are present and in good condition.

Vertebra : All 24 vertebra are present and fairly in good condition.

Pelvic : Pelvic is in good condition of preservation.

Femur : Both the femur are intact with crack and fracture.

Patella: Both the patella in good condition and placed in a right place.

Tibia : Both the tibia in good condition with some cracks.

Fibula : Both this fibula is placed laterally and in good condition.

Digits : Right lower extremity is placed laterally and left medially are above the other and in good condition of preservation.

This adult female specimen is one of the best preserved specimens of this series. All body parts are represented and the bones show much less weathering than other specimen. Skull is complete and undamaged. The robusticity expressed in features like supra-orbital ridges, temporal lines mastoids and the nuchal area is comparable with other female specimens of this series. Face is slightly prognathous and alveolar prognathism is evident too.

Not many measurements / observations are possible at this stage.

Orbital breadth	R	–		L	40
Height	R	–	31	L	30
Upper facial height					69
Nasal height					49
Nasal breadth					21
Subnasal height					19
Minimum breadth asc. Ramus					30
Chin height					34
Ganion-gnathian length					85

No observation is possible for dental inventory for the maxillary right side. Except lateral incisor all other teeth of the left side are present. Mandibular dentition appears to be complete on both sides (RM2, RM3 region was not exposed fully). Both the premolars of left side are lost postmortem.

Thoracic cage is nicely preserved with most of the ribs and entire vertebral column. Long bones are measured for length dimension and the observations are as follows:

Clavicle	R	-14.5	L	14.6
Humerus		32		-31.8
Radius		23.4		-24
Ulna		26.5		25.5
Femur		44		44.5
Tibia		36		35.7
Fibula		35.7		34.4

Estimated height is 165.00 cm. The female sex of the individual is

determined on the basis of sciatic notch, sub-pubic angle and the orientation of iliac blades.

The pattern in selecting the earthen wares for female funerary rites is a unique phenomenon noted at this site. All the female burials have been offered vases, jars, goblets and dish-on-stand. Such mind set for observing regulated female funerary rites denotes special status for married women in the Harappan society.

RGR-7 Burial no. 8

This grave-pit yielded an extended human skeletal remains oriented north-west to south-east with head raised almost vertically. It has been found in poor state of preservation. The shoulder girdle is lopsided. This adult individual is represented by fragmentary cranial and post-cranial remains. Damage has occurred to the thoracic cage resulting in almost complete loss of right ribs. Right humerus is missing so also the proximal one third of right radius and left palella. Many cracks have developed in the long bones. The damage is mainly attributable to the ploughing activity and the excavation process.

Description of skeletal remains:

Skull : Skull is fairly intact with some crack and fracture.

Mandible : Mandible is good in condition.

Dentition : All 32 teeth are intact and in good condition.

Clavicle: Clavicle is in good condition but left clavicle is articulated and raised.

Scapula: Right scapula is damaged and left is not visible.

Sternum : Sternum is missing.

Ribs : Only few ribs are available most of either damaged or missing.

Vertebra Columns : Vertebra is partly visible and partly below the soil and very fragile.

Humours : Right humours is completely damaged and missing. But the left humours is raised and proximal and placed near the maxilla.

Radius: Right radius is damaged and missing from proximal and left 3 in fairly good condition and placed medially.

Ulna : Both the Ulna placed laterally and developed some cracks .

Upper Digits : All digits are present in fairly good condition.

Pelvic : Pelvic is well preserved with slightly articulation.

Femur : Both the femur are in good condition.

Patella : Left patella is missing right patella is good in condition.

Tibia : Tibia is damaged and broken into pieces.

Fibula : Fibula is not visible.

Lower Digits: Tarsal Metatarsal and phalanges are well preserved.

Skull is complete after entire facial skeleton in articulation. Slight damage is evident in the supra-orbital region. The individual is moderately built with prominent glabella and mastoids. Temporal lines are moderate, so also the supra-orbital ridges. Eyes are rectangular/oblong in shape.

Maximum cranial length (178) - occipital is not full exposed.

Maximum cranial breadth 133

Orbital breadth	R	41	L	41
Orbital height		33		38
Nasal height		48		
Length of nasal				-23
Nasal breadth				23
Subnasal height				22
Min. frontal breadth				94
Frontal chord				98
Frontal are				112
Mandibular height	R			54
Mi bread asc-ramus				23
Chin				30
Gonion-				88
Bizygomatic breadth				134

Dentition is complete in left perspective with fully erupted third molar. Right side and not fully exposed.

Long bones are moderately robust.

Humerus	R	37	L	36
Radius		–		27
Ulna		29		-
Femur	R	49	L	48
Tibia		-42		-42
Clavicle		-		15

Estimated stature is 178 cm; robustly expression and the morphology of sciatic notch indicate male sex of the specimen.

At the time of excavation a red ware bowl was found placed in the north western corner of the pit but at the time of lifting the skeletal remains six more earthen wares vessels were collected from northern portion of the grave-pit.

RGR-7 Burial no. 9

This is a disturbed burial and only the left temporal, parietal and part of left face is preserved. Maxillary bone is present but all teeth have been lost. There is no trace of mandible.

Mastoid is very prominent, so also the nuchal region but sex cannot be positively determind, on the basis of this robusticity.

No grave goods have been collected.

RGR-7 Burial no. 10

This is disturbed and incompletely imposed burial. Only bone visible is the right tibia mid-shaft. Along with this few animalbones also reported.

As per grave goods one earthen ware, identified as mature Harappan medium sized pot has been reported.

RGR-7 Burial no. 11

A uniformly deep grave-pit of oval shape with a slope from north to south has yielded human skeletal remains laid in north-south orientation in supine position. It is an elaborate burial of a female wherein the types of

earthen wares are identical to those noticed arranged systematically in the burial no. 6 and 7. In addition to pair of shell bangles in her left wrist, her neck was adorned with a necklace of steatite consisting 408 micro beads. The micro beads of the necklace have been found embedded around right portion of the skull and neck. Both these ornaments are signatures of married women who were given burial with her ornaments on person. There are Vedic accounts to corroborate such practice wherein married women have been recommended to inter with her jewelry when her husband is alive.

There are thirteen earthen wares arranged behind the head which comprise of vases and jars of low neck, goblet, beaker bowl-on-stand and dish-on-stand.

General description of the Skeleton:-

Skull :- Skull is fairly intact with some crack and fracture.

Mandible: Slightly articulate and well preserved.

Dentition : Upper incisor are missing.

Clavicle: Both the clavicle is articulated but in well preserved condition.

Scapula: Right scapula is partly damaged whereas the left scapula is well preserved.

Sternum: Sternum is in right place.

Ribs : Few pairs of ribs are in good condition and well preserved.

Vertebra Column: Vertebra is clearly visible and very fragile.

Humours : Humours is rightly placed and well preserved.

Radius : Both the radius are fairly in good condition and placed medially.

Ulna : Ulna is fairly good condition and placed laterally.

Upper Digits: All digits are present in fairly good condition.

Femur: Both the femurs are in good condition.

Patella : Both patella are in good condition and placed in right place.

Tibia : Tibia is rightly placed and good in condition.

Fibula : Both fibula are in good condition.

Lower

Digits : Right Tarsal, metatarsal and phalanges are missing, possible, because of the latter grave-pit actively where as the left all lower digits are well preserved and in good in condition.

Measurements of bones could not be recorded at the site. However the maximum stature of this individual was 167 cm.

Interments in the Settlement Area

Evidence of primary burials has been recorded from the habitation levels of RGR-1 and RGR-2. Those found at RGR-1 are of formal nature while out of the two from RGR-2 one appears to be aberrant while the other regular. Additional evidence from RGR-2 is that four cinerary urns. Even today the villagers of Rakhi Khass and Rakhi Shah use these two mounds as child burial ground. Occasionally, RGR-1 is used as cremation ground as well. The first season's field work at RGR-1 has reported four primary burials with brick appendages, two (Burial 1 and 2) were found on the eastern and western margins of G5-1 while the other two in G5-2. The grave pits dug to a varying depth ranging from 1.20 m to 1.80 m, each contained corporeal remains laid in the north-south direction with head to the north and legs to the south. Except burial no. 2 which contained grave goods, rest of them were devoid of such offerings. Absence of grave goods reminds burials of Bhagwanpura in the late Harappan context. Nevertheless, entombment of burials at this site is of special interest as these appear to be reminiscent to those noted at Mehargarh in the Harappan context.

Skeletal Record of Terminal Occupation Levels from RGR-1

There are four burials subjected to detailed probing which had one factor in common that each of the funerary pits had mud bricks appendages wherein inter were of extended variety. This type of hypogeum burial has been classified as chamber tombs (Sarianidi 2008). The skeletal remains at RGR-1 are in fragile condition. The cause of decay may be attributed to the funerary practice in a chamber where empty space was created around the corpse. Similar observations have been made elsewhere in the proto historic burial context (Sellier 1992).

RGR-1 Burial no. 1

Located towards the eastern margin of G5-1, the rectangular grave-pit was embellished with mud brick masonry on the eastern margin. The first four courses were laid straight one above the other in alignment while remaining four courses were successively corbelled in a manner to form an overhanging ceiling which was further concealed by adding an additional course of mud bricks. Interments in corbelled chamber remind their Vedic antecedents wherein there is reference to interring in a *bhumigrih.* There is a reference to house of the earth (मृन्मयंगृह) in the *Rigveda* (*RV*. VII. 89. 1) and a mud chamber (भूमिगृहो) in the *Atharvaveda* (*AV*. V. 30. 14).

At places, there is evidence of wilful removal of upper courses of mud bricks for pilfering the grave goods.

The skeleton found in very fragile condition was laid in north-south orientation in supine position. Most of the bony parts are in position but poor condition of bones prevented further exposition of bones of skull, thorax, pelvic girdle, carpal and phalanges of fingers. The left hand is crossed parallel to pelvic girdle whereas right over lower abdomen. Head to the north is partially tilted to the west while the legs are stretched and tapering to the south and parts of tarsus and phalanges are set close to each other. The height of the individual is 165 cm. Projection of frontal bones, length of humerus, ulna and radius, femur, tibia, tarsal and phalanges of feet suggest skeleton of middle aged person. The individual may be identified as female on the basis of broad ilia. Further osteological studies may further help in determining sex.

RGR-1 Burial no. 2

Located towards the western margin of G5-1, the skeleton of an adolescent was found in a rectangular grave-pit dug to depth of 1.20 m. There are couple of brick appendages at the surface of the pit which served as soling. Basal surface of the pit was further given saggy treatment to accommodate the corporeal remains of a differently able adolescent. The skeleton is laid in north-south orientation with head towards north and legs south. The head partially raised is tilted towards west and so is the torso

turned partially to right. Number of bones is damaged or missing which include skull bones, left upper and forearm, left lowers leg and other bones of lower extremities. Both the clavicles and left scapula are dislodged. Thorax bones are badly damaged. Right thigh bone is fragile. The right femur, patella, tibia and fibula have been partially propped up with the support of thick sherd of red ware. Complete absence of bones of left arm indicates physical disability of this adolescent. The stage of adolescence has been determined on the basis of epiphyseal fusion of long bones, coronal suture and blind sign of left mental foramen. Skull bones are very smooth, without any marked muscular ridge. The teeth are intact. The grave goods include a carinated *handi* of red ware placed to the north of head and a hopscotch dressed out of thick red ware placed to the north-west of head and a burnt brick opposite face of the deceased.

RGR-1 Burial no. 3

It is another exemplary burial with brick appendage located in the cutting of G5-2 where in the deceased was laid in supine position in north south direction, head towards the north and legs south. The grave-pit was dug to a depth of 1.30 m with an additional scooping of western margin of the pit to form an overhanging vaulted chamber for interment. It appears that a mud brick wall of six courses was laid on the corresponding side of the eastern margin. The upper courses were laid in offset not only to function as props but also narrow the margin of aperture in the vault to minimise the space of concealment by arranging a series of mud bricks in oblique order. There after the overhead arrangement was concealed by thick mud cladding which can be observed towards the southern margin (fig.). The grave-pit has not yielded any grave goods, but there are discreditable facts to suggest that it was plundered at a later stage. To substantiate this fact it is noted in the course of excavations that an opening was found in the vaulted chamber by dismantling obliquely laid mud bricks arranged in the northern portion. This pillage has not only reversed the understanding of funerary rituals but created doubts about its antiquity. However, there are certain elements to suggest its antiquity with the Harappans. For examples

the basal surface of grave-pit was treated with a slope from north to south which is a common feature at the cemetery site of Rakhigarhi. The space behind the head is sufficient for placing pots and pans which were subjected to looting. Above all, the mud floor over the obliquely laid mud bricks happens to be sealed by layer 3 as well as certain mud bricks used in the makeup of grave-pit bear the ratio of 1: 2: 4 justifying its Harappan antiquity.

Reverting to corporeal remains, it is noted that indiscriminate plundering has caused irreparable loss to the upper part. The skull bones are relatively dislocated if viewed in the context of shoulder girdle. The skeleton is laid straight in the north south orientation without any magnetic deviation.

Skull bones are damaged beyond repairs except the remnants of frontal and parietal bones. Series of bevelled tips of left ribs and lumber potion of vertebral column are visible but in poor state of preservation. So is the case of pelvic girdle. Right arm bones displaced from the shoulder girdle are relatively articulated. Upper end of humerus is broken but lateral supra condylar ridge is articulated with proximal end of right radius and ulna. Their distal ends are in bad shape. Only few bones of right hand in fragmentary condition are noticed against the right pelvic bone. Pelvic girdle is articulated but other than the hip bone and detached sacrum rest of the bony components are destroyed. Both the thigh bones are stretched in supine but narrowing towards kneecaps. The distal end of left femur is fragile so is the kneecap and proximal end of leg bones. Right fibula is hidden below the right tibia. Tarsal bones of both the feet have crumbled while few phalanges are seen disjointed.

Measurements of long bones:

Humerus	(R) Proximal end broken	25 cm
Radius	(R)	28 cm
Ulna	(R)	30 cm
Femur	(R)	41 cm

Tibia	(R)	37 cm
Fibula	(R)	36 cm

Estimated stature of this individual is 168 cm.

RGR-1 Burial no. 4

Another burial numbered as 4, augmented with mud bricks was exhumed in the cuttings of G6-2 which was sealed by layer 3. Oriented north south, the oval grave-pit was dug to a depth of 1.75 m with an addition of cavern undercut on the adjoining western margin of the longer axis. The pit was cut through a solid mud brick platform. The western section shows cutting of two upper courses laid in headers and stretchers mode, while the lower three successive ones are on edge laid horizontally. On the other hand three courses of mud bricks seen cut in the section of northern side are laid on edge in vertical order.

The grave-pit measures 2.10 x 1.05 m. Its eastern margin was integrated with mud brick wall of six courses, wherein the first four courses were laid in stretchers order but bond of upper two courses was set in headers and stretchers respectively. The headers are jutting out in sight angle to support overhead weight of corbelled ceiling of the grave chamber.

Appendage of mud brick wall, seemingly added to after interring as the lower most course follows the left margin of body line. At this stage of interment were inserted two mud bricks in vertical mode parallel to the left shoulder and head of the deceased. Final packing of vacant space between wall and cutting line was conducted with a caution to prevent indentation in the brick work. Some of the brick sizes reported here revealed the ratio of 1 x 2 x 4 (8 x 16 x 32 cm; 7 ½ x 15 x 30 cm; 10 x 20 x 40 cm and 6 ½ x 13 x 26 cm) compatible to the brick standard of the mature Harappan period.

The basal surface of the pit follows a gentle slope from north to south which appears to have been treated by spreading loose earth before placing the body over it. This individual was put to rest in supine position with skull

turned to west with a marginal deviation to 14^0 N. The skull is showing a good lateral view combined with left eye socket and nasal bone; jaw bones are damaged but collarbones and shoulder blades are visibly intact. All the vertebrae are in good condition but sternum has disintegrated. The upper half of the skeleton is more or less straight as compared to lower half. Both the hands are stretched parallel to the torso. Right upper arm and fore arm are lying in prone position, while left humerus has developed crack and portions of fore arm are embedded. Right hand is better preserve but hand bones are bent up forming an obtuse angle. The pelvic girdle is damaged but the broad outline of sciatic notch suggests female sex for this individual. Both the thigh bones are marginally deviated from the pelvic girdle which spread out and starched parallel to each other. Kneecaps are damaged but the leg bones are better preserve than those of the feet bones. The stature of this adult individual is 1.58 m.

Measurements of long bones in cm

Humerus	R	28 cm	L	28 cm
Radius	R	22 cm	L	–
Ulna	R	21 cm	L	–
Femur	R	36 cm	L	35 cm
Tibia	R	28 cm	L	28 cm
Fibula	R	–	L	26 cm

Skeletal remains of RGR-2

There is evidence of two skeletal remains from the habitation area of RGR-2 wherein one of an adolescent is dumped on the street adjacent to a covered drain while the other of an adult is laid in flexed position.

RGR-2 Burial no. 1

The human skeletal was located in T23/2 over layer 8 at a depth of 2.75 m which was sealed by layer 7. It is a disorderly disposal of an adolescent located adjacent to a covered street drain. The trapezoidal formation of the skeleton and disjointed limbs together suggests some kind of traumatic experience of infantile paralysis (poliomyelitis) or some

pathological disorder the individual suffered during his lifetime. Keeping in view the parallel torso (thorax bones), the skeleton is in south-north orientation, where the head is stretched up towards south-west. The right leg is stretched up in the north-west direction forming an obtuse angle. The thigh bone of left leg runs parallel at the back of torso and extends behind the neck while the lower bones extend up in right angle in westerly direction. The left parietal bone and part of zygomatic arch are damaged. Skull is tilted to its right side all the teeth of upper and lower jaw are intact of which the left side are visible. The mouth is agape. Second cervical vertebra (axis) is detached from the spinal cord. Both collar bones are dislocated. Right shoulder blade is placed over the corresponding ribs while left one is in its normal position. Left arm blew humerus is missing while the right upper arm and fore arm (ulna and radius) are seen extending underneath the torso. The right ribs are relatively better preserved than the left. The lumbar vertebrae are visible but detached from sternum, thus pelvic girdle. Left femur, patella, tibia, fibula, tarsal and phalanges are found with breakages.

The skeleton as such is in good condition and has been attributed to an adolescent on the basis of inadequate epiphyseal fusion of long bones, absence of mental foramen over the chin and lack of fusion in coronal sutures. Tentatively on the basis of broad left ilium, this individual has been identified as female.

Traumatic skeletal remains are at times noticed without any clear evidence of intentional interments sometimes 'dumped unceremoniously into pits' without any formal ritualized body posture. Whatever the causes of death may have been, the traumatic deceased were discarded in lanes and adjoining unattended structures for reasons having to do more with demographic and social factors than pathology (Kennedy 1984:433).

RGR-2 Burial no. 2

This is a flexed burial, located in S-23/2. Due to periodical erosion the outline of the grave-pit could not be traced. However, it was located at depth

of 2.17 m resting over layer 7. The periodical erosion marked by series of ripples traced behind nape of the neck has disturbed the arrangement of grave furniture. The pots recovered from the pit include a medium sized globular vase, lid cum bowl and a fragment of large basin, all of red ware.

The skeleton is laid in south east and north-west direction. The deceased seems to be a differently able person who was laid in a flexed posture to his right in a specially prepared grave-pit. It had slope from either ends converging in the centre. Therefore, both the extremities of the skeleton are raised at either ends and sloping towards sagging pelvic girdle.

Bony portions of arms, legs below thigh bones, left ribs completely and right marginally are missing. The upper frontal and left parietal bones of skull are damaged due to inflammation in the substance of bones. The lower frontal bone, nasal aperture, maxilla and mandible spotted with the left mental foramen are available. From the position of the maxilla and mandible it is clear that the jaw is in an articulated state. All the teeth are intact and pressed against each other. The face is turned to right and bent downward still the condyler region is seen articulated with the skull. The vertebral column is dislocated in the middle and detached from pelvic girdle. Due to external pressure of the brick appendage both the ilea are partially compressed thus disjointing the crouching thigh bones which are broken at the distal end. Both the thigh bones are amputated at the distal end indicating physical disorder which might have deprived burial in the cemetery area. The wider sciatic notch indicates that it is a skeleton of a female.

There is a trace of white line over the surface of grave-pit following the body line of skeleton which can be seen along the head extending further towards the torso. With a note of caution, one may take this mark of white line as evidence of wrapping the body of deceased as part of interment ritual. Such interment ritual have come to light from Harappa (Wheeler 1947) and Daimabad (Sali 1986, Pl. LIV) where a reed shroud skeleton and fibrous plant material sticking to the skeleton respectively were noticed.

These archaeological data have bearing in the traditional account where laying of body of deceased over the spread of *barhis* grass finds reference (*RV* X. 15. 9-10). Likewise, laying of body on the right side with legs drown up in a burial pit also finds reference in the Vedic context (*RV* X. 15.6).

आच्या जानु दक्षिणतो निषद्येमं यज्ञमभि गृणीत विश्वे ।
मा हिंसिष्ट पितरः केन चिन्नो यद्व आगः पुरूषता कराम ॥६ ॥

The above hymn explains nature of interring on their right side with legs their legs drawn up in a crouched position. The bending up of the lower and upper limbs against torso and face respectively resembles an unborn child in the mother's womb.

Concluding Remarks

It has been noted that during the first field season (1997-98) the cuttings of RGR-1 and RGR-2 had yielded evidence of primary burials, but for one each of aberrant and flexed type in RGR-2 rest are regular extended ones. Evidence collected from funerary pits of cemetery area (RGR-7) helps in the reconstruction of beliefs pertaining to life after death as well as assist in understanding a pattern of mortuary rites followed by the Harappans at Rakhigarhi and elsewhere at sites like Kalibangan and Farmana, where more or less an identical pattern of disposal has been observed. The individuals having some kind of physical disorders were given interment in the habitation area as there is no evidence of such burials in the cemetery area RGR-7. The extended type of primary burials with brick appendages reported from RGR-1 is from terminal occupation levels wherein interments are of normal physical stature.

With regard to disposal of dead in the grave-pits with brick appendages there is a reference to house of the earth (मृनमयंगृह) in the *Rigveda* (*RV*. VII. 89. 1) and a mud chamber (भूमिगृहो) in the *Atharvaveda* (*AV*. V. 30. 14). Similarly, laying of body on the right side with legs drown up in a burial pit also finds reference in the Vedic context (*RV* X. 15.6). Likewise, the grave goods in the form of jewellery and offering of grains and

other food items in earthen wares to the deceased also finds reference in the Vedic context (*AV* VIII.4.25, *AV* VIII.4.26, *AV* VIII.4.30) The verses invoke Agni to protect these offerings from harm or injury in order to serve its cause. At the same time it also explains the functions of pots and pans placed in the burial pit as utensils to keep offertories like... cake, milk , curd, *ghee*, meat, juices, honey, other eatables, some mixed with sesame seeds and so on (Bisht 2014). A few of the inferences from *Atharvaveda* (*AV* VIII.4.25-26) are appended:

अपूपापिहितान् कुम्भान् यांस्ते देवा अधारयन् ।
ते ते सन्तु स्वधावन्तो मधुमन्तो घृतश्चुतः ॥ 25 ॥

The above hymn describes the offerings of eatables prepared out of rice cakes mixed with ghee (पुऐ) and are place in covered earthen vases (कलश or कुम्भ) which are full of fatness and honey and juices.

यास्ते धाना अनुकिरामि तिलमिश्रा:स्वधावती :
तास्ते सनतूद्भ्वी मन्यताम् यमोराजानु प्रभ्वीस्तास्ते :ll26ll

This refers to offerings consisting of grains and sesame seeds soaked in water and heated in pans, offered as safe passage through the netherworld.

It is apparent that types of pots offered to the graves had a function to hold eatables as enumerated in these hymns.

The cemetery site (RGR-7) has revealed special mortuary practice accorded to adult female sex. In such burials was noted high percentage of earthen wares as compared to adult of opposite sex. The female burials were offered dish-on-stand, bowl-on-stand, goblet, beaker, globular jars, medium and miniature vases, dishes and basin, whereas the opposite sex offered limited number of pots consisting of bowl, dish, medium and miniature size vases. At the time of interment, an adult married female deceased had the option to inter with modest personal ornaments over their person in a situation when their husband was alive. Such evidences have been reported from RGR-7 Burial nos. 1, 7 & 11, supplementing the inference of the Rigveda (*RV* X. 18.7):

इमा नारीरविधवाः सुपत्नीराञ्जनेन सर्पिषा सं विशन्तु ।
अनश्रवोऽनमीवाः सुरत्ना आ रोहन्तु जनयो योनिमग्रे ॥ 7 ॥

'Let these women who are not widows, who have good husbands, enter (anointed) with unguent and butter. Let women without tears, without sorrow, and decorated with jewels first proceed to the house' (Arya, *et al.* 1997:235).

The RGR-7 Burial no. 3 is apparently that of a female sex but the grave-pit has not yielded any ornaments. It may be surmised that at the time of her interment she was either a widow or unmarried hence deprived of such adornment.

Incidents of overlapped cutting of pits have been noticed in case of burial no. 6 & 7 and 1 & 4. Burial no. 4 shows sign of a mud brick on the eastern margin of pit line (Fig.). Presence of a mud brick alignment in the grave-pit has been regarded either as mark of coffin or burial chamber. Limited evidence of brick appendages has come to light from cemeteries of the Harappan and late Harappan origin as illustrated in the map (Fig.). However, the terminal burials of RGR-1 have provided a set pattern of brick appendages in the grave-pits aligned in the eastern margin, reminiscent to those reported at Mehrgarh (Cucina and Petrone 2003: 81).

The skeletons in RGR-7 burial nos. 3, 4, 6 and 7 seem to have been laid over specially treated floor of river borne compact clay of yellow colour mixed with lime-like substance. Effect of partial mineralization has been noticed over the skeletons laid in these graves. Similar treatment to the grave-pits has been observed at Burzahom (Singh 1970: 172) Kalibanga (Thaper 1975) while at Mehrgarh the same has been marked with red ochre (Cucina and Petrone 2003: 81).

Evidence of fibrous shroud has been observed over the pit surface of RGR-7 burial no. 11. There is a mark of dark linear substance over the base of the pit surface running on either side of the upper vertebrae of skeleton (Fig.). Wrapping of deceased in some fibrous material at the time of interment appears to be a practice known to the Harappans and the tradition even continued in the later phase. Residue of a shroud around pelvic girdle to the upper vertebrae has been spotted at Harappa (Wheeler

1947; Dales and Kenoyer 1991) and in later context at Daimabad (Sali 1986: 175). Inference of wrapping of dead body with flax occurs in the Rigveda besides laying of deceased over the spread of *barhi* grass (Rao 1978: 142; Bisht 2014; *RV*. X. 15. 3-4).

These burials are direct evidence of religious beliefs of a class of opulent people who believed in the interment practice. There were other sets of people across the Harappan domain who believed in different modes of disposal of dead as the cemeteries are far and few between. Nevertheless, such evidence reflects on the composition of population of elites only, leaving other sets of population in oblivion in the absence of biological data. Though the biological studies of Rakhigarhi remain yet to be initiated, their relationship with the population of Harappa is a subject of postulation which requires thorough morph metric analysis. However, in this regard it has been observed (Kennedy 1982:191) on the basis of skeletal studies from Mohenjodaro and Harappa that there are certain biological continuum in the modern population of Punjab and Sindh, thus the population was relatively of homogenous nature (Dutta 1972). It is quite lightly that the study of skeletal biology from Rakhigarhi may reveal similar results as the two sites of Punjab and Sindh fall in the shared socio-cultural domain of the Harappans.

The skeletal series exhumed form Rakhigarhi is definitely was of robust type comparable to the modern population of undivided Punjab. Males are approx, 171-178 cm in height, while females vary from 155-165 cm. Other noteworthy feature is straight face and occasionally slight alveolar prognathism. Chalcolithic series give more degree of facial and alveolar prognathism. Nose is straight in Rakhigarhi, while the Chalcolithic people had concavity in nasal bones. Dental health is good besides attrition, calculus formation seems to be common, but caries are less in frequency (comment to be verified (later). There is not much of antemortem tooth loss. Non-eruption of third molar as seen in this series is quite common in agricultural population in comparison with the hunting gathering Mesolithic populations. This is because of the sophisticated food preparation methods

which results in reduction of masticatory stress. Some specimens in the lumber region show traces of vertebral lipping. Observation of such degenerative pathological lesions would need thorough scrutiny of the skeletal elements preserved.

It would be worthwhile to take up biological studies of the present skeletal series in order to assess their lineage and continuity. Recent researches based on Harappan skeletal series have highlighted on the element of heterogeneity in Harappan population (Walimbe 2011; Ratnagar 1998) of the subcontinent. Studies with regard to broad pathological categories, traumatic lesions caused by injury or malformation of the skeleton, diseases that affected joints, age-specific diseases, metabolic diseases, new bone formation if any, dental diseases etc. are currently in progress (Walimbe 2011: 340). In this regard a comparative study of skeletal series of Kalibangan and Farmana would be of immense value as these sites fall in the cultural landscape of the Saraswati-Drisdhavati divide.

Table showing basic details of each burial located in the cemetery at RGR-7

Sr. No.	Burial No.	Locus	Sealing layer	Cultural Phase	Gender	Deviation from Magnetic North	Orientation of Skull	No. of Pots	Antiquity	Dimensions of the grave-pit			Age	Remarks
										Length	Width	Depth		
1	RGR 7/1	R20/1(a)(b)	1	Phase 2	Female	19^0	North west to south east	21	Gold fillet, two gold and stone beads, a shell bangle	190 cm.	90 cm.	63 cm.	Adult	The skeletal remain is cut from distal end of femur.
2	RGR 7/2	R20/1(b)	1	Phase 1	Male	19^0	do	03		230 cm	70 cm	30 cm	Adult	Parietal and frontal skull damaged due to static pressure.
3	RGR 7/3	R20/1(d)	1	Phase 1	Female	15^0	do	07	Steatite beads	235 cm	68 cm	30 cm	Adult	Parietal and frontal skull damaged due to static pressure.
4	RGR 7/4	R20/1(c)	1	Phase 1	Male	15^0	do	03		235 cm	70 cm	40 cm	Adult	Lower extremities missing.
5	RGR 7/5	R20/2(a)	1	Phase 1	-	19^0	do	08		200 cm	90 cm	20 cm	Adult	Damaged due to agricultural activity
6	RGR 7/6	R20/2(d)	2	Phase 2	Female	0^0	North to south	11		65 cm	105 cm	60 cm	Adult	Other than skull rest is cut by later pit of burial no. 7
7	RGR 7/7	R20/2&3	1	Phase 1	Female	0^0	North to south	12	Pair of shell bangles	265 cm	100 cm	80 cm	Adult	On display in the National Museum New Delhi
8	RGR 7/8	R20/1(c)	1		Male	15^0	North west to south east	7		220 cm	80 cm	60 cm	Adult	Lower extremities missing.
9	RGR 7/9	R20/3	1		-	-	-	2		-	-	-	Adult	Couple of pots exhumed south of burial no. 7
10	RGR 7/10	R20/3	1		-	-	-	2		-	-	-	Adult	Couple of pots exhumed south of burial no. 7
11	RGR 7/11	R20/4	3	Phase 1	Female	15^0	North west to south east	14	Pair of shell bangles and a necklace of steatite	265 cm	95 cm	105 cm	Adult	Relatively skeletal remains is mineralized

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Chapter 7

Ceramic Assemblage

Pottery is a wide spread craft, which still continues. Although after the invention of several metals and technology, vessels made up of clay have its own importance. It is the oldest of all crafts that evolved at the dawn of civilization. Pottery occupies a unique position by its distinguishing and characteristic features as well as by its distribution in different periods and areas. It might be accidentally the baking of pottery invented but today it has its value when it is baked in higher temperature. Clay is the most abundant of all material in this world. It has the quality of taking any shape, desired to be given.

Pottery in Archaeology

Pottery is considered to be the ABC of Archaeology. It helps one to bind up the sequence of the cultures and to reconstruct the material culture of the ancient people. Pottery is the only material readily available from the ancient sites and therefore, serves as an index of the cultures of the people who inhabited these sites. It is not only helpful for the identification of a civilization but also to compare and characterize it. Pottery types and shapes might have undergone mild or wild changes according to the taste and needs of the people who belong to one culture of another.

Distribution of Harappan pottery in a wide area in the northwest India indicates the extent of the Harappan civilization. Similarly, the find of Black and Red ware with megalithic burial context in number of sites in South helps us to trace the origin and spread of Megalithic culture in India. The discovery of Roman pottery in south India indicates the cultural and trade contacts that existed between South India and Rome

in early historic period. The paintings executed in the pottery shows aesthetic and artistic sense of people during that period. It also indicates socio-economic and religious condition of that period.

Thus the importance of the pottery for the study of ancient past cannot be exaggerated. Khare is not unjustified when he says that "It is not merely the ABC of archaeology but ultimately proves to be A to Z of this subject."[1]

Here the study is concerned with the Ethno-archaeology of cut wares. Ethno-archaeology is "defined broadly as encompassing all the theoretical and methodological aspects of comparing ethnographic and archaeological data". Ethno-archaeological research can take place among any extent people, it should be focus on archaeological motivated questions and ultimate objective of ethno archaeology should be to keep understand the past.

Potteries bearing the cutting designs or incisions on the body surface as decorative or for functional purposes are called as Cut wares. Shape of the perforations includes horizontal, vertical, triangular, rectangular, circular and sometimes other designs also. Some cut marks are deep and some are blind with the types like terracotta lattices, headrest vessels and so

Early Harappan ceramic industry shows all the six Kalibangan fabrics including the technique of surface treatment, shapes and decorative elements. The pottery was essentially wheel made with a few exception of hand made specimens. It was relatively thin and light fabric, red to pinkish in colour and painted in black, combined at times with

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[1] Sinha, B.P. (ed) 'Potteries in ancient India'. Patna (1969). P29

white, over self-slipped dull surface. The design elements were essentially geometric. The simplest among them included horizontal bands, row of dots, latticed triangles, fish scales etc. Motifs used as filler were radiating lines ending in solid disks, four petalled flowers, pipal leaf and circle with radiating arches. Shapes included the jar with an out turned rim, basin and dish on stand. Apart from red ware, the site had yielded both plain and painted variety of grey ware.

Some sherds from this level were identified as 'Hakra ware' includes incised applique, dendrite, ribbed and striated ware. The Mature Harappan levels here yielded classic red and grey ware; also few sherds of non-glazed reserve slipped ware. Here red ware is divided into Red-slipped, Black painted red slipped and black painted ware. Important shapes in red ware included perforated jars, goblets, dish -on-stand vase, jar, legged rim vessel, fluted vessel, ribbed vessel (handi) dish, basin etc.

Though grey sherds are less in number as compared to red ones, they are present in almost all level. These sherds are plain and do not bear any painting. The main shapes in Grey ware are vases, dish-on-stand, dish, bowl and lid. Paintings are usually found in horizontal or vertical panels mainly on red slipped surface. The important motifs are pipal leaf, palm leaf, traingle, loop, intersecting circles linear designs etc. Besides this, a few sherds with bird and fish decoration are also found.

Cut Ware

The objective of the work is intended to document the primary source and to understand the antiquity, typology and technical know how. In addition an attempt has also been made to understand the existing tradition through an ethno archaeological study.

Methodology

The methods followed in this work are:-

1. Descriptive analysis
2. Comparative analysis
3. Typological analysis

The work is discussed under three main chapters

1. Antiquity of cutwares: The first chapter is dealt with antiquity of the cutwares both in Global and Indian perspective.

2. Technical and Typological study of cutware: The second chapter dealt with technique of cutware and typological analysis with the sub-topics – functional and non functional classification.

3. Ethnoarchaeology of cutware: The third and last chapter dealt with ethnoarchaeological study of cutware in detailed manner.

Antiquity of Cutware

The antiquity of cutware in global and Indian context starts from ceramic phase of Neolithic period. Example from India is Burzahom and Kuladur, which might have contact with Harappan civilization. The

ceramic phase of Neolithic is very late in India. Here the antiquity of cutware both in India and global context is discusses with few sites. Since the study is mainly concerned with ethno relations of this ware, more concentration was given to that and it helped to trace the continuity from Neolothic period to day-to-day life and the period that has taken for antiquity of cutware is from Neolithic to Early historic period.

Indian Perspective

The antiquity of cutware in undivided India (including Pakistan) goes back to Neolithic period. Sherds are obtained from various sites, which are discussed below with chronological order. It is classified into three periods.

1. Pre-historic period
2. Proto-historic period
3. Historic period

Pre-historic Period

The ceramic phase of Neolithic have some evidences of this ware. The sherds are very limited in number and no intact piece is found. The sites are Burzahom (C 3000 BC – 1800 BC), Kuladur (C 3000 BC), Kanispur (C 2000 BC – 1000 BC), chirand (C 2000 BC – 1200 BC), Nagarjunakonda (C 2500 BC).

Burzahom, Kuladur and Kansipur are in kashmir, Chirand in Bihar and Nagarjunakonda in Andhra Pradesh. Dish-on-stand of black polished ware with incised geometrical design yielded from Burzahom and another two similar pieces are from Kuladur, the designs are in blind mode. The sherd from kansipur has burshing treatment with reeds to

make the surface of the wet pots has smooth, have left the vertical, horizontal and slanting marks of groovings. Sherds from Chirand have mica particles, which are appearing on the surface of the pot sherds. Neck fragment of an Urn type with incised uprights, made with a blunt edge of coarse fabric with longer incised stroke made with a sharp edge is yielded from Nagarjunakonda.

Proto-Historic Period

In India protohistory spans the period from C 3000-600 BC. Covering the Bronze Age and chalcolithic cultures, from the beginning of Harappa or Indus valley civilization upto the beginning of the historical period in the sixth century BC. The sites that are yielded the cutwares are Mohen-jodaro, Harappa, Chanhudaro, Burhanewala Theri (C 2500-2000 BC), Surkotada (C 1940-1790 BC), Swat (C 1400-800 BC). Amri period IIIc has a base and a lower body of a vessel with lenticular cut outs located above two deep horizontal grooves. Mohenjodaro yielded more sherds and types of cutwares differ from different sites.

The Chalcolithic sites that yielded these wares are ahar (C 1950-1500 BC), Inamgaon (C 1000-700 BC), daimadad (C 1500-1100 BC), Koathe (C 2200-2000 BC).

Megalithic Period

Cutwares are yielded from Cist, Cairn burials and they are different from the cutwares of other periods. The sites are Yeleswaram (C 200 BC – 100 BC), Tirukampuliyur (C 300 BC – AD 300), Brahmagiri and Sanur (C 100 BC – AD 50). The circular stand from Yeleswaram is very fine example of cutware. The incense burner from Tirukampuliyur, Lids from brahmagiri and Sanur also comes under the category of the cutwares.

Historic Period

The historic period spans from sixth century BC and sherds are yielded from excavated sites belongs to different periods and different types. The sites are Atranjikera (C 600 BC), Kayatha (C 200 BC – AD 600), Vaisali (C 200 BC – AD 200), Adam (AD 200- AD 400), taxila (C 100 BC- 50 AD), Bilram (C 200 BC – AD 200), Paharpur (AD 900). In historic period very few sites are taken for study. Detailed types of cutware in Neolithic, Protohistoric, Megalithic and Historic period are discussed in the succeeding chapters.

Technical and Typological study of Cutwares

Technique

Basically the technique of cutware is cutting out designs with some sharp instruments like knife. The detailed account of the techniques which might follow in ancient times is discussed below.

Preparation of clay and making of the pottery

The clay may be obtained either from deposits on the riverbank or dry beds of lakes. The clay intended for making pottery was devoid of impurities and possesses fine plasticity for better quality. Plasticity and smoothness of the clay may differ from region to region. The final stage of the preparation of the clay was attained after it undergone the process of Levigation, Treading and kneading.

There are two methods employed in the making the pottery

1. Handmade
2. Wheel turned

Making incision and cutout designs

In early times, the pottery was made by hand (handmade Pottery). After the invention of the wheel, potteries were made out of them. The cutting out designs and incisions were done prior to firing.

The required shape and designs were made and they were dried to leather hard condition. The incision or cutting might have been made out by some sharp instruments like,

1. Bone or Stone Pin[1]
2. A metal knife
3. Sharp edge pottery
4. Mortar Blade or Flint knife[2]
5. Splinters of Bamboo

The technique of piercing the walls of specialized vessels with triangular, concave sided triangular and biconvex designs are found. Most of the examples are crudely executed and no attempt has been made to smooth the irregular edges of the perforation on the concave side of vessels. The edges of the cuts, which are made from the exterior side of the vessels, or not perpendicular to the surface. They slant sharply inward, either braking through the wall of the vessel in an area smaller than the external size of the cut design or they met at a point before piercing the vessel's wall. This suggests that cut designs are basically decorative rather than functional and more care would have been taken to make each design pierce the wall.

[1] Verma, A.K. 'Neolithic culture of eastern India'. Delhi (1988), p.50
[2] Watelin, 'Excavation at Kish'. Vol-IV.Paris (1934).p.15.

Surface treatment and paintings

Most of the examples are devoid of slip or any special surface treatment apart from that related to the cut designs, but some sherds are executed with yellow, black, red and brown slips. A sherd from Mohenja-daro (fig. VIb) was the most elaborate example of the special surface treatment[1]. The sherd has wide areas of white and red paint.

There is also other example from Chanhu-daro headrest adorned with various devices in a purplish black paint[2].

In recent times, these cutout designs are done with various methods and instruments like stencils and Electric spray guns, which are discussed in chapter 3.

Typology

Cutwares yielded from the excavated sites are classified into different types based on it function. Although the type indicates the function, it is necessary to study the reason behind the cut which were pierced the vessel's wall and in few cases did not pierced. They were done it deliberately and might have served as a decorative rather than functional

The typology of cutware has been classified into two sections

1. Non-functional Classification
2. Functional Classification

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[1] Dales, G.F and Kenoyer, J.M 'Excavation at Mohenjadaro, Pakistan-the Pottery' (1986) fig 93.2
[2] Mackay, E.J.H. 'Chanhu-daro excavation 1935-36'. Varanasi (1976) pl. XCII -6

Non-functional Classification

The Non-functional Classification of typology deals with different kinds of modes, paintings and slip that are executed and the common designs of cuttings found in this ware.

The non-functional typology is further classified into

1. Open mode
2. Blind mode
3. Painted mode
4. Cut design mode

It is mainly concentrated on cutting design rather than function of a cut ware as a whole. The function of a particular type cutware has been described typological in the next sub-title.

Open mode

The designs were done in such a manner that the cuttings finely pierced the wall of the pottery. Here the cutting designs would be mostly functional has like in the cases of window-gratings, face-urn, incense-burner, flesh-rubber, printing block and masks from the sites like Chanhu-daro, Surkotada, Harappa, Ahar and so on. The model of the window from Harappa serve as an evidence of window gratings that are used as ventilators and also a function of open mode cutting that are found in them.

Earthenware of Paharpur, Burhanewala Their, Ahar and other sites having these open mode where might have served the function of chilam or for the refraction of light through the cuttings (when the lamp was kept inside the cutware). Face Urn from Gandhara grave culture

and mask from Harappa is having the open modes top indicate the eyes, nose and mouth.

Blind Mode

The cutting design that does not pierce the wall of the pottery properly is called Blind mode. It was done deliberately in most cases and might be for both decorative and functional purposes. Earthern ware from Kansipur, Kaothe and Dish-on-stands from Kuladur, Kansipur, Burzahom and Dwaraka are having blind mode of cutting design. The window gratings having this mode may indicate the decorative purpose where as in the stand and dish on stand might have done to reduce the weight of the pottery along with the decorative aspect.

Painted Mode

It is noteworthy to mention here about the paintings and slips that are executed in this ware. This might be for decorational purpose and very few sherds are executed with paintings that too colours are mostly black ad white. Window-grating from Mohenjodaro is executed with white and red paint, but headrest of chanhudaro is coated with cherry coloured slip and adorned with various devices in a purplish black paint. Interesting factor to be noted here is the painting designs on the incense burner from Daimabad. Each curved horns and square opening are painted with ochre-red colour where as corners of the four sides is painted alternatively in red and white pigments with vertical lines.

The various colour slips are also executed on the cutware, in many cases it is red and white, comtimes cream, brown and cherry coloured slip are also found. Window-gratings of Mohenjodaro has white slip whereas stands from Chanhudaro has cream and brown slip.

Cut design mode

The designs that are found in the cutware are done with some sharp instruments. The design will give the idea about the aesthetic sense of the potter and of the whole society. The designs are mostly geometrical like triangular, square, rectangular, oblong, circular, parallelogram and very rarely swastika designs. These designs are found both in open and blind mode.

The dish-on-stand from Kuladur, Burzaham, window grating from various sites, earthen ware from Kish are all having the triangular cutting design which might be the easiest design to be done next to circular punctures. Some of the punctures are in series and some are not. Potter might have drawn the design on the surface of the pottery before the cuts were made. Now-a-days stencils are used to make the designs[1].

The unique piece is intact container from Adam, which has jail sides by arranging series of swastika motif. The cutwares that are still continuing today have different cutting designs along with the geometrical designs that are discussed in the third chapter.

Functional Classification

The typology according to the function deals with the purpose of the cutware and the context where it has been used is discussed in a detailed manner below.

Some of the types of cutwares are

[1] Owen. S.Rye and Evan, Cliford. 'Traditional pottery and technique of Pakistan'. p 88.

1. Window-gratings
2. Stands (offering, circular and dish-on-stand)
3. Earthen ware (vessel)
4. Incense-burner
5. Head-rest
6. Mask
7. Face-urn
8. Printing-block
9. Pedestal
10. Flesh-rubber
11. Lid.

Window-grantings (fig. VI)

These are decorative pieces fixed on the walls, to serve as ventilators or windows for providing more light and air, into the interior of a house and it also prevent the ingress of birds or other creatures. Mohenja-daro yielded more pieces whereas other sites yielded very few. The majority of grills being made of wood may perhaps explain their rarity. A miniature window model was found from Harappa, which serves as an evidence of using window-gratings, and it was a quite important architectural feature of the Harappan houses.

Terracotta window-gratings from Mohenjo-daro were light grey, yellowish, red and light red in colour. Sherds reported from other sites like Chanhu-daro, Harappa, Surkotada and Ahar are similar to Mohenja-daro whereas window-gratings from Vaishali has big square hole (fig.VIj) when it is compared to other pieces. The shape of the cuts in Mohenja-daro is almost triangular and floral whereas in Ahar it is circular and oblong.

Sl.No	Site	Ware	Surface treatment	Period	Date	Fig. No
1.	Mohenja-daro	Lightgrey	Whiteslip	Harappan	2500-2000 BC	VI a-d
2.	Mohenja-daro	Yellowish-red	White & red paint	Harappan	2500-2000 BC	VI s
3.	Mohenja-daro	Red	--	Harappan	2500-2000 BC	VI 1
4.	Mohenja-daro	Yellowish-red	--	Harappan	2500-2000 BC	VI r,t
5.	Mohenja-daro	Red	--	Harappan	2500-2000 BC	VI m,o
6.	Mohenja-daro	Light Red	--	Harappan	2500-2000 BC	VI k
7.	Mohenja-daro	Light Red	--	Harappan	2500-2000 BC	VI n
8.	Chandu-daro	Light Red	--	Harappan	2500-2000 BC	VI e
9.	Harappa	Red	--	Harappan	2500-2000 BC	VI p
10.	Harappa	Red	--	Harappan	2500-2000 BC	VI q
11.	Surkotada	Red	--	Harappan	2500-2000 BC	VI f
12.	Surkotada	Red	--	Harappan	2500-2000 BC	VI g
13.	Ahar	Coarse red	--	Ahar	2150-1950 BC	VI h

14.	Ahar	Coarse red	--	Ahar	2150-1950 BC	VI i
15.	Vaishali	Red	--	Kushana	200 BC-AD200	VI j

Remarks

1. The pattern was scratched on the unbaked clay.
2. It has an elaborate window like design.
3. 7.1 inches long and 0.9 inches thick.
4. Cut was done from exterior surface and interior edges were not smooth.
5. 4.8 inches long by 0.95 inches thick.
6. It is a flat piece of 0.95 inch thick.
7. Similar to above (6).
8. Cuttings are in oblong shape.
9. It has floral design cuttings.
10. It has perforation in the center and roughly decorated with scratch lines.
11. It has design of shallow incised diamonds each with perforation.

Stand

Terracotta stands with cutting designs are reported from the sites like Burzahom, Kuladur, Chanhu-daro and so on. Mosly the shapes of the stands are circular. Dish-on-stand which is the main pottery variety of the mature Harappan with cutting design on the stem portion of a stand is also obtained from Kuladur and Burzahom may indicate their contact with the Harappan people.

An offering stand from Mohenja-daro are similar to the offering stand from Susa and in Egypt from Pre-dynastic times down to the sixth dynasty[1] and stands of shorter type recovered from Samara in the same country[2].

It is noticed that these cutwares has triangular or circular holes and also in a few cases other designs are found, but it is important to note that in the cases referred to perforation are in general triangular in form and they were cut with a sharp instrument before baking. Perforation of this kind would have been useful in reducing the weight of the stands and if the stands were used for water jars, the holes might promote evaporation from the vessel itself or of the water which percolated through[3].

The Inter-tidal zone in Bet-Dwaraka II yielded dish-on-stand of red ware. This pottery is wave rolled, especially the stand part of dish-on-stand is indicate of the survival of late Harappan ware in second quarter of second millennium B.C.

Another important piece is from Yeleswaram, it is a circular stand of black ware with rows of triangular and rectangular perforations. This stand was provided with projection at the top, to fit in the sockets of a large sized squatted dish with parallel side, externally groove neck. It is obtained from Megalithic cairn burial.

[1] De-Morgan, la prehistoric orientale, t-11, pp284-5.
[2] Herzfeld, Ernest, 'Die Vorgeschich Elichen top Ferejen Von Samara Vol-V' (1930). Pp 37-8.
[3] Mackay, E.J.H. ' Further excavations at Mohenja-daro'. (1978), p.182 VII.

Sl. No	Type & Site	Ware	Surface treatment	Period	Date	Fig. No
1.	Dish-on-stand/Burzahom	Black polished	-	Neolithic	3000-1800 BC	VII h
2.	Dish-on-stand/ Kuladur	Burnished	-	Neolithic	3000 BC	VII g
3.	Offering stand/Mohenja-daro	Yellowish red	-	Mature Harappan	2500-2200 BC	VII a
4.	Stand/ Chanhu-daro	Pink paste	Cream slip	Harappan	2500-2000 BC	VII b
5.	Stand/ Chanhu-daro	Pink Paste	Brown slip	Harappan	2500-2000 BC	VII c
6.	Stand/ Chanhu-daro	Pink Paste	-	Harappan	2500-2000 BC	VII d
7.	Stand/ Chanhu-daro	Pink Paste	-	Harappan	2500-2000 BC	VI e
8.	Dish-on-stand/ Kansipur	Grey	-	Neolithic	2000-1000 BC	VII f
9.	Dish-on-stand/ Dwaraka	Red Ware	Wave rolled	Late Harappan	2200-2000 BC	
10.	Circularstand/Ahar	Coarse red	-	Ahar	1950-1500 BC	VII i
11	Circularstand/ Inamgoan	Gritty red	-	Late Jorwe	1000-700 BC	

12.	Circularstan d/ yeleswaram	Black	-	Iron age	200-100 BC	VII j

Remarks

1. It is incised with geometrical design
2. Triangular cutting design on the surface.
3. Triangular cutting design on the surface.
4. The sherd is illustrated as slightly curved.
5. It is a piece of long stand
6. Taken from inter-tidal zone
7. Raised band is found along the periphery.

Earthen Ware (Fig. VIII)

The curvature and considerable thickness of the pottery indicates that they may be the part of a vessel or a pottery used as a cilam or vessel to keep inside it to protect from the wind. Cilam is a bowl or a vessel connected with a pipe to smoke tobacco. Even today they are in use particularly in the northwest frontier provinces of Pakistan[1] .

It is note worthy to mention, vessels from Kaothe and Adam. A pot sherd from Kaothe belongs to Savalda ware which has flaring mouth and it is decorated with incised chevron pattern, below which are inverted triangles filled in with punctured holes. In Adam, an intact container of medium size was reported which has convex base and straight profile with jalee sides devised by arranging series of swastika motif.

[1] Owen.S. Rye and Evan, Cliford, "Traditional pottery and techniques of Pakistan" p.88.

A dull red ware vase bearing grooves with notches externally reported from Bilram shows the continuity of cutware in pre-Muslim period. It has been noticed that cutware from Burhanwala Their and Mohenja-daro are having similarity with the vessel of Kish.

Sl.No	**Site**	**Ware**	**Surface treatment**	**Period**	**Date**	**Fig. No**
1.	Chirand	Coarse red	--	Neolithic	2000-1200 BC	VIII c
2.	Kansipur	Red	--	Neolithic	2000-1200 BC	VIII b
3.	Mohenja-daro	Yellowish red	--	Harappan	2500-2000 BC	VIII f
4.	Mohenja-daro	Yellowish-red		Harappan	2500-2000 BC	VIII g
5.	Burhanewala-their	Light red	--	Harappan	2500-2000 BC	
6.	Ahar	Coarse red	--	Ahar	2150-1950 BC	VIII a
7.	Kaothe	Red	--	Savalda	2200-2000 BC	VIII e
8.	Adam	Red	--	Satavahana	AD 200 - 400 AD	
9.	Paharpur	Red buff	Red slip	Early pala	AD 900	VIII d
10.	Bilram	Dull Red	Red slip	Pre-Muslim	AD 850-1110	

Remarks

1. It has oblong cutting design and may be apart of a bowl.
2. It may be a part of a gobular vessel.
3. It has five horizontal rows of string impression just below the point of maximum body diameter.
4. It has triangular holes.
5. It has neat circular perforations made from outside.
6. May be a part of a storage jar.
7. Circular holes on the body.
8. May be part of a vase.

Incense burner

It might have been used for putting incense in houses as a part of ritual or for fragrance. In some cases incense burners were found along with burial where it may symbolically indicates the putting incense to the soul of the dead.

A burnished ware from Jorwe Phase of Daimabad was identified as incense burner. Interesting factor of this burner is on stand with four curved horns, one each at each corner and square opening are painted with ochre-red colour, whereas corner four sides are painted alternatively in red and white pigments with vertical lines. Incense burner of black and red ware with red slip belongs to Iron age obtained from pit-circle in Tirukampuliyur. The incense burner on stand from Megiddo cult of Israel had some similarities with Indian incense burners, since it was also painted with red colour and used for ritual purpose.

Head-rest

A very fine headrest belongs to Jhukar culture is reported from Chanhu-daro. It has a length of 12.3 inches, 2.4 inches thickness and tapers to 1.6 inches at the top. It is coated with cherry colour slip and adorned with various devices in purplish black paint. A portion had been hallowed out of each side to reduce the total weight, leaving a vertical pillar in the centre, where the head would press most heavily[1], on each side of the wall, triangular cutting have been made perhaps to reduce its weight further.

Pottery "neck-rests" as they were originally designated by Foote were first reported by him from the site, t. Narsipur, on the cauvery basin[2]. But their actual use and significance were not known. In T.N. Narsipur the headrest was found in the burial near the temple of the skull. Thus the use of this headrest was sepulchral.

In Egypt headrest were found in the royal burial chambers from pre-dynastic times down to the Roman period. These are made of wood, stone and sometimes pottery. Similarity in shape and the association of the pottery headrest may indicate the possible contact with Egypt during this period. Wooden headrests are still said to be in some of the SouthEast Asia counties. In Africa many tribes such as 'Makabanga' and 'Maszona' tribes of southern Rhodesia and Baluhas of Cargo still use wooden headrest[3].

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[1] Mackay, E.J.H, 'Chanhu-daro Excavations -1935-36', Varanasi (1976) p 73.
[2] Rao, nagaraj M.S. 'Proto-historic cultures of the Tungabadra Valley'. (1984) Delhi p.97.
[3] Ibid.

Mask

A miniature mask or pendant of a being with tiger's maw, human eye and possible mustache and bovine-horn reported from Harappa. The face has two holes perforated at each edge and may have been tied on to a puppet or worn as a pendent. Similar beard and thick lips, but with a closed mouth have been recovered from Mohenja-daro.

Face-Urn

A face-urn of red ware belongs to Gandara grave culture of Swat dated back to C 1400 to 800 BC is a cutware since it has cutting design to indicate eyes, nose and lips and looking like a face of a human being. It has a similarity with the face-urn from Troy II which was looking like a face of a man with cutting marks to indicate the eyes, nose and lips.

Printing-Block

Terracotta printing block of northern black polished ware for printing design is reported from Atranjikhera. It is square in shape with decorative triangular holes.

Pedestal

A rectangular pedestal with regular rectangular perforation in rows was reported from Taxila, which might have served as pedestal to keep heavy objects or sculptures, was dated back to c 100 BC to AD 50.

Flesh-Rubber

An oblong flesh-rubber of red ware decorated with crescent cut marks on both the surfaces, which belongs to Sunga period is reported from kayatha.

Lid

A funnel shaped lid of black ware with a straight lip and flang bell having discontinuous groove on the outer surface is reported from Sanur, which belongs to Iron age dated back top 200 BC to AD 50. A similar lid of blackware with incurved lip and multiple grooves on the outer surface is reported from Brahmagiri Megalithic pit-circle.

Sl. No	Type & Site	Ware	Surface treatment	Period	Date	Fig. No
1.	Incenseburner/ tirukampuliyur	Black and red	Red slip	Iron Age	300 BC – AD 300	X b
2.	Incenseburner/Daimadad	Burnished	White and red paint	Jorwe	1500-1100 BC	X a
3.	Head-rest/ Chanhu-daro	Red	Cherry slip-black paint	Jhukar	2000-1500 BC	IX a
4.	Mask/ Harappa	Red	-	Harappan	2500-2000 BC	XI a
5.	Face-urn/Swat	Red	-	Gandhara Grave	1400-800 BC	X c
6.	Printing block/Atranjikera	NBP	-	Early Historic	600-300 BC	XI c
7.	Fleshrubber/	Red	-	Sunga-	200 BC-	X d

	kayatha			Kushana	AD 600	
8.	Pedestal/Taxila	Red	-	Early historic	100 BC-AD 50	XI b
9.	Lid/Sanur	Black	-	Iron Age	200 BC-AD 50	
10.	Lid/Brahmagiri	Black Polished	-	Iron Age	200 BC-AD 50	

Remarks

1. It is on a stand.
2. The resting portion has designed such a way that it will give more comfort to head when it rest on it.
3. Two holes might have been tied on to a puppet.
4. It is a heavy piece.

There are few more types like Birdcage. The detailed account of Ethno study of this cutware technique and typology are given in the following chapter.

Ethno-Archaeology of Cutwares

Ethnoarchaeology is defined broadly as encompassing all the theoretical and methodical aspects of comparing ethnographic and archaeological data. The goals of ethnoarchaeology are to formulate and test archaeologically oriented and derived methods, hypothesis, motels and theories with ethnographic data. The ultimate objective of ethnoarchaeology should be to help understand the past in better manner. The ethnoarchaeology focuses on the interface between the material culture on the one hand and human behavior, organization,

meaning and environment. It is the method of understanding the past by addressing questions with modern day material culture.

Ethnoarchaeological researching contrast is not so limited. Ethnoarchaeology to explore beyond techno function in to the areas of artifact socio and ideo functions. A number of ethnoarchaeological studies have explored how non-techno functional factors affect the manufacture and use of material items. More over, ethnoarchaeology can also develop material behavioral or material organizational correlates at higher levels of abstraction. Examples of such research includes demonstrating correlation between architecture and house hold sizes, investigating the relationship material items and wealth and studying the factors involved in the production and distribution of pottery.

The tradition of making cutwares is still continuing in some part of the country. When compare to the archaeological data the cutware of today are having various types and cutwork designs. Almost all the states of India this tradition is continuing for some ritualistic and decorative purpose. It is possible to see the use of cutwares more in Delhi. Even the lamp shade post erected on Rajpath and around the India Gate resembles this pottery lamp shade. This cutwork pottery is called Jhanji ka kam in Delhi. Both Indians and foreigners are craze of collecting this pottery for decoration purpose. There is great demand of this particular type of pottery since it is both decorative and cheap.

They are chosen for study is Delhi. The author particularly in Paharganj also interviews some potters. In other areas like Uttamnagar, Ramnagar, Bindapur, Palam colony these cutwares are found. Smt. Kamala who makes and sells this cutwork pottery says that this Jhanji ka kam has very good demand. Foreign customers and elite homes are prominent among those who patronize cutwork pottery and buy them.

Some of the foreign customers place specific orders in advance. She continues that terracotta jalee does not have demand but this is the likely product of the future, considering the spread of architecture in the construction of even middle class homes and possible progress of initiative famous constructors to promote construction with indigenous material and flavour. Even now order flow from building contractors to a tradition rooted and at the same time forward looking potter who makes glazed terracotta jalee.

Potter's locality and population

Smt. Shantha Krishnan in her books 'Traditional potters' as given detailed information about the potters community and localities in Delhi. The total numbers of Kumhar (potters) households in identified localities are 1,899. These households exist in varying concentration in different localities. The total population of Kumhars in the 40 localities is 9,063. Not all of engaged in production of pottery goods. The male and female balance in potter households are based on the biological factor, subject to some social distortion brought out in the section on gender ratio. In the case of the potters, the biological factor is reinforced by the occupational, sociao-technological characteristic requiring atleast one person at the wheel and one person in all processes except work at the wheel and firing the kiln, for pottery production on self employment basis.

Table – Potter's locality in Delhi

S.No.	Name of Locality	% share in total population	S.No.	Name of Locality	% share in total population
1.	Pahar Ganj	5.9	16.	Nandnagari Munirkagaon	1.4
2.	Ajmeri Gate	17.3	17.	Sikhribhatta	1.3
3.	Bindapur	12.3	18.	Hauz Rani	1.1
4.	Chirag Delhi	6.2	19.	Chhatarpur	1.0
5.	Sabzi Mandi	5.6	20.	Mangolpuri	0.9
6.	Shahdara	5.1	21.	Sastri Nagar	0.9
7.	Roshanara road	2.9	22.	Sarojini nagar	0.8
8.	Sultanpuri	2.8	23	Azad pur	0.6
9.	Palam Colony	2.7	24.	Arjun nagar, Trilokpuri	0.5
10.	Mahavir nagar	2.6	25.	Sukurpur	0.4
11.	Mohamadpur	2.6	26	Green Park Extn.	0.2
12.	Malkaganj	2.5	27.	Ambedkar Nagar	0.2
13.	Karol Bagh	2.3	28.	Kiriti Nagar	0.1
14.	Madhipur	2.3	29.	Tihargoan	0.1
15.	Trinagar	1.8	30.	Wazipur	0.1

* Courtesy: Shantha Krishnan's 'Traditional Potters'

The bulk of individual whose main occupation is pottery belongs to the youthful and middle age groups 15 to 35 and 36 to 49. Old age does not give respite to craftsmen. Out of 70 percent of total number of persons in the age group 60 and above engaged in pottery making.

Role of women in Pottery making

It is one of the serious errors of the statistics including the census to lose the sight of the role of women in productive activities like pottery and other crafts. According to the statistics the proportion of women is 48 percent in pottery making. By tradition the wheelwork and igniting the kiln are the only two processes with which women are not associated. But the numerous other processes, like the preparation of clay before wheel work, making designs and cutwork, painting, loading the dried wares into the kiln and unloading the baked wares, stacking the ware, preparing dung cakes to be used as fuel for the kiln are all process of pottery in which women are fully associated along with men. In the case of making cutwork design also women are doing different cut designs and models after it was wheel turned.

Migration from other states

The potters indulged in cutwork pottery and other types can be divided into two categories: 1 Indigenous potter, 2 Migrant potters. The potter population of Delhi has consisted of a large number of migrants from rural Rajasthan, Haryana and Uttar Pradesh. The migration occurred in different period. The basic reason of migration of potters who indulged in making cutwares is because of new nature and dimensions of the market demand in the metropolis. In one of the localities it was mentioned that every month one or two families are

moving in. There are indigenous potters also who indulged in this work for many generations.

Marketing

The cutwork potter of Delhi manufactures both traditional and new products. The traditional objects like miniature shrines, lampshades are produced which may be used for ritual purposes. They also manufacture the new products like wall plate, flower vase. Their new general cutware products are diverse in nature and use, and bear the distinct impress of the urban and metropolitan pattern of life.

Sri Bathri Lal, 43 years old who, lives in Paharganj eloquently described this situation in the following words, “the market is no problem, there is plenty of demand and there is no off season and always work is there. It is only during the rainy season he has to limit the amount of his work for reasons other than demand”-During Dewali demand is very much and he works late in to the night. The good demand for some of these is predicted on a high level to skill on the part of the potter. Therefore, not all potters at present are in position to take advantage of it. The expert potter who is successfully marketing glazed terracotta jalee also finds that non glazed jalee are not profitable enough because cement jalee and iron grills are more in demand. A potter sells this cutware by various ways.

It is considered to be the most advantageous from the point of view of maximing his returns. It brings them better income if they sell by their own. There are different ways in which the potter sales his pottery.

a. Sales by potters in their home premises.
b. Hawking by potters on pheri.

c. Sales direct to commercial and business users.

d. Direct sale to Govt. or public sector.

e. Sales in haat (traditional market functioning on certain days of weeks).

f. Sales in exhibition

g. Sales by potter trader.

h. Sales by shop keepers.

Technique of making cutwork pottery

The technique of making cutwares in modern times is same as ancient period. There is no limitation in implements to make cut designs. Potters are using even the cap of a ball pen, hairpin and other sharp day today useful materials then normally little size axe blade is used in free hand to make designs (Plate A). Implements are little bit different in other places like Pondicherry, Karaikuruchi of Tamil Nadu. They use metal knives to make cut designs whereas in North frontier provinces in Pakistan decorations are made with bowl shaped metal stencils which are placed over the exterior of the bowl and pigment is sprayed on the bowl through perforated patterns in the stencils. An electric spray gun in used for this purpose. The bowls are then glazed by dipping in a water suspended glaze contained in a large drum. The glazed are allowed drying before the bowls are set in the kiln. The design that are found in modern cutwares are having both geometrical designs are triangle, rectangle, circular, parallelogram and non-geometrical design like star design and heart shape design. The potter also executes paintings and slips if customer wishes to do.

Typology

Even through the area is concerned with Delhi a unique type called Cilam from Pakistan lamp shade and flower vase from Pondicherry are also given under typology. Potters of Delhi and other places are ready and skillful to make any sort of design and types in cut wares, if we show the model. This work concernes with ethnoarchaeology and not with experimental archaeology, the types and designs that are already made by potters are given below with their uses and designs found in them.

1. Diwali lamp
2. Lamp Shade
3. Flower vase
4. Mode of a hut
5. Miniature shrine
6. Wall plate
7. Jalee
8. Cilam
9. Miniature pots

Diwali Lamp

It is a wheel made pottery having lamp on the top and around the neck portion. In between the neck and the top and neck portion are having triangular and small circular holes in range. The body is pierced with some holes like triangular and crescent shape design. These diwali lamps also act as a lampshade.

Lamp Shade

The aim behind making this type is to safeguard the light from heavy wind blow. Now a day it is used mostly for decorational purpose. When the light passes through the cut design it refract on out side. The lamp sherd from Paharganj has triangular and flower petal design cutting on the body. Slip is also executed here. Lamp shades from Pondicherry have circular, triangular, star shape and heart shape and parallelogram holes. In India gate electric bulbs in the lamp post are having these lampshades.

Flower Vase

The flower vases from Pondicherry are having circular and star shape hole. The potter Sri Shivalingam says that, this flower vase has got good demand among middle class and elite people. Paints of different colours are also given if customer wishes.

Model of a hut

The miniature hut having rectangular and triangular holes as window along with arch design entrance on front and sides are found in Paharganj. It is a hand made pottery and the designs of holes are punctures for window purpose are differing from potter to potter as their wish. It has great demand since it is very cheap and nice decorative object. It can be compared to model of a hut from Denew (Gumelinta culture).

Miniature shrine

This shrines are made mostly for ritual purpose and this is a circular shrine with kalasa on the top surrounded by lamps is having triangular cut designs around the wall and rectangular entrance. The

pedestal of the shrine was made separately along with some deity like Ganesa in the center point. Then the circular part is placed above the pedestal. Already the tradition of making miniature shrines is found from Casciorele and Neonikomedia of Europe.

Wall Plate

In a circular clay plate the potter does cut designs with free hand. It can be fixed in the wall and paintings are also done for decorative purpose.

Jalee

Terracotta jalee also have great demand among the middle class people. It is cheap comparing to cement and iron grills. The tradition of this jalee continues right from Indus Valley civilization (window gratings)

Cilam

It is either the base or lower vessel of a tobacco smoking pipe device or the entire device consisting of the bowl for the tobacco called 'topi', the base vessel and connecting pieces and tubes. The word hooken refers only to the complete device with all its parts and is synonymous with cilam when used in the sense. In the North frontier province of Pakistan the tradition is still continues.

Miniature Pots

This miniature cutwork pottery may be used for some ritual purpose.

Conclusion

The art of making cutware both in ancient period and modern period is almost similar. As it is discussed in the earlier chapters, the antiquity of cutware both in global perspective and Indian perspective are available. In the global context, it goes back to prehistoric period. Some of the reported examples are from Europe, china, America, Greece, Iraq, Egypt, Israel, Japan are discussed in the first chapter. It includes different types and purposes like Miniature shrine, Incense burner, Pedestal cup, soul house, Keyhole tomb and so on. The antiquity of cutware goes back to C 4000 BC in global context.

In India, it goes back to Neolithic period. The reported site is Burzahom, where part of Dish-on-Stand is reported. The tradition of this continues in Harappan civilisation which is considered to be contemporary to Neolithic Burzahom and tradition still continues today. The cutware reported from various sites have different purposes from one another. Typology and technique are discussed in the second chapter in which it was mentioned that cut designs are done with sharp instruments like mortar blade, metal knife, bone, stone pin splinters of Bamboo. In this chapter, it is mentioned about different types of cutwares like Window gratings, Stands, Earthenware, Incense burner, Headrest, Face-Urn, Printing block, Cutting shapes includes Square, Circular, Parallelogram Triangular, Oblong and Diamond.

Some similarities and differences are found in modern cutware technique as like using of stencils and any sharp implements that is available like tip of a hairpin and cap of a ball point pen. Decorational types are also different from ancient times to present day. Of course there are some types which resemble ancient examples but some latest decorational types are noticed in Ethno archaeology, which was done in

Delhi and Pondicherry clearly reveals the taste, artistic mind and value of decorational.

The field work in Paharganj-Delhi has given good results and it is great to know that this traditional work gives good income to this particular potter's society, because of its decorational value. This has great demand among both Indians and foreigners.

Ethno-archaeology has given lot of information about potter's community, women's role in this work, making techniques different types, sales marketing technique, demand and it also proves the continuing tradition. It will be more informative, if experimental archaeology is also carried out along with Ethno studies.

As a conclusion this work it has been clearly proved that the tradition of making cutwares, its types, techniques are almost same as like in ancient period with little technological improvement and typological variety and it has great demand all over the world for both decorational and ritualistic purpose.

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Chapter 8

Graffiti

The word 'Graffiti' implies as scratch, inscription or drawings scribbled or sprayed on a surface. It is the plural form of word 'Graffito.' In archaeological literatures, different types of scratched marks usually on pottery and sometimes on other materials (terracotta, stone, metal, bone) are referred to as Graffiti. There are divergent opinions among the scholars regarding the significance of Graffiti. According to one group these are nothing but potters logo to express their ownership. Others say these are associated with magic or sanctimonious rituals. There is another group which correlates these marks with the origin of writing. The ability to express the thoughts and emotions in form of symbol is a special capability of human beings and its evidence is available in Prehistoric period. During the later period these symbols of human expression standardized, giving rise to the script. The growth and development of a script was a slow process which continued for centuries till a perfect stage was achieved. There are examples from the Early Harappan horizons where the graffiti marks have been incised in certain order thereby indicating an early beginning of inscribing the symbols in groups. These evidences may be taken into account to study the evolutionary process of the Harappan script.

The earliest evidence of use of script in Indian subcontinent is attributed to the Early Harappan horizons datable to 4th -3rd millennium BCE. So far the Harappan script has remained undesiphered hence it is difficult to trace evolution of the same. On basis of available facts it may be suggested that the graffiti marks found on pottery can be preliminary form of the Harappan script.

The antiquity of Graffiti marks dates back to the Neolithic Period but its frequency increases through the stages of development from the

Early Harappan period down to the emergence of script. In Harappan context, it has been reported from all the important sites. Rakhigarhi also yielded a variety of graffiti marks inscribed on potsherds and other materials. After the minute study, the Graffiti marks of Rakhigarhi can be categorized as follow:

Graffiti marks ----- (1) Marks engraved randomly

(2) Marks engraved with some objective – this can further be subdivided in three sub groups – a) Potters marks b) Artistic signs c) The signs showing close resemblance to Harappan Script.

The study has revealed a variety of signs, some of them are of common occurrences comparable from other sites. The graffiti marks have been classified on the basis of its characteristic feature while a few appear random in execution. These types of signs are –

*** Drawing of graffiti marks remains to be prepared for insertion***

The potter marks which have usually been found on the base and sometimes on the rim, were mostly engraved in leather hard condition. By these marks the potter can easily identified his production. Generally these marks were engraved as vertical or slanting stroke (may be single, double or triple), two vertical strokes are joined with slanting stroke etc.

This group may represent the artistic feeling of Harappan people. The signs of this category are in form of swastika, star, arrow, tree like shape etc.

There is another group of graffiti marks which shows close resemblance with Harappan script. During the course of study of the graffiti marks obtained from Rakhigarhi, it has been observed that 44% and 70% signs show close similarity with Harappan script in Early Harappan and Mature Harappan level respectively. This study also point

out towards this fact that during the Early Harappan stage the system of writing was in its initial stage and it has been properly established in Mature Harappan stage. It has also been observed that the graffiti marks of Early Harappan period of Rakhigarhi contain few simple signs in the form of vertical, horizontal and slanting strokes which may be one to fourteen in number. In succeeding stage these simple lines were jointly engraved and apart from straight strokes the curve lines and circular form were also added as composite sign. The gradual development of some signs may be seen in following table:

First Stage Lower level of Early Harappan deposit	**Second Stage** Upper level of Early Harappan deposit	**Third Stage** Mature Harappan level

Gradual development of some Graffiti marks

This analysis clearly indicates that during the Early Harappan Period the graffiti marks were not executed on a proper system which could only be established in the succeeding Mature Harappan level.

Description of Graffiti marks on potsherds

RGR – 1

Sl. No.	Graffiti	Locus	Layer	Depth in cm	Type of Vessels	Remarks
1		R-3/2	1 S.B.10	405		Post firing, light incision, wash, Red Ware
2		R-3/2	1 S.B.10	395		Post firing, light incision, wash, Red Ware
3		M-5/2	15	375		Post firing, light incision, wash, Red Ware
4		L-5/3	14	350		Post firing, light incision, chocolate slip, Red Ware
5		L-5/3	15	350		Post firing, light incision, wash, Red Ware
6		M-5/2	14	315	Lota	Post firing, light incision, chocolate slip, Red Ware
7		R-3/2	10	305		Post firing, deep incision, wash, Red Ware
8		R-3/2	12	318		Post firing, light incision, wash, Red Ware
9		R-3/2	10	295		Post firing, light incision, wash, Red Ware

10		K-3/2	13	286		Post firing, deep incision, chocolate slip
11		L-5/1	2 S.B.10	284		Post firing, light incision, chocolate slip
12		L-5/1	2 S.B.10	291		Post firing, light incision, chocolate slip
13		L-5/1	2 S.B.10	291		Post firing, light incision, chocolate slip
14		K-3/2	13	280		Post firing, light incision, chocolate slip
15		R-3/2	9	280		Post firing, light incision, wash, Red Ware
16		R-3/2	9	282		Post firing, light incision, chocolate slip
17		L-5/1	2 S.B.10	271		Post firing, light incision, Slip, Grey Ware
18		M-5/2	12	270		Post firing, light incision, wash, Red Ware
19		R-3/2	9	270		Post firing, light incision, wash, Red Ware
20		R-3/2	9	269		Post firing, light incision, chocolate slip
21		L-5/1	11	268		Post firing, light incision, chocolate slip
22		R-3/2	11	267		Post firing, deep incision, wash, Red Ware
23		R-3/2	9	267		Post firing, light incision, wash, Red Ware
24		L-5/1	2 S.B.10	262	Pot	Post firing, deep incision, Wash, Red Ware
25		L-5/1	2 S.B.10	270		Post firing, deep incision, Wash, Red Ware
26		R-3/2	9	255		Post firing, light incision, wash, Red Ware
27		R-3/2	8	254		Post firing, light incision, wash, Red Ware

28		L -5/ 4+3	11	250		Post firing, light incision, slip
29		N-11/2	1 S.B.6	250		Post firing, light incision, Chocolate slip
30		L-5/1	11	249		Post firing, light incision, wash, Red Ware
31		L-5/1	11	255	Beak er	Post firing, light incision, Chocolate slip
32		L -5/ 1+2	10	249		Post firing, light incision, Chocolate slip
33		R-3/2	8	245		Post firing, light incision, wash, Red Ware
34		R-3/2	8	243		Post firing, light incision, wash, Red Ware
35		N-12/4	1 S.B.6	240		Post firing, light incision, Chocolate slip
36		L-5/1	10	240		Post firing, light incision, slip, Grey Ware
37		L-5/1	10	239		Post firing, light incision, Chocolate slip
38		L-5/1	10	238		Post firing, light incision, Chocolate slip
39		R-3/2	8	240		Post firing, light incision, wash, Red Ware
40		R-3/2	7	234		Post firing, light incision, wash, Red Ware
41		R-3/2	7	234		Post firing, light incision, wash, Red Ware
42		L-5/1	10	232		Post firing, light incision, wash, Red Ware
43		L-5/1	10	232		Post firing, light incision, wash, Red Ware
44		L-5/1	10	242		Post firing, light incision, wash, Red Ware
45		L 5-3+4	10	230		Pre firing, deep incision, wash, Red Ware

46		N-12/4	7	230		Pre firing, deep incision, wash, Red Ware
47		L-5/ 1+2	10	223		Post firing, deep incision, chocolate slip
48		L-5/ 1+2	10	220	Basin	Post firing, deep incision, wash, Red Ware
49		L-5/ 1+2	10	220		Pre firing, light incision, wash, Red Ware
50		K-3/2	11	220		Post firing, light incision, wash, Red Ware
51		L-5/1	9	210		Pre firing, deep incision, wash, Red Ware
52		M-5/2	10	208		Post firing, deep incision, Chocolate slip
53		M-5/2	9	195		Post firing, light incision, Chocolate slip
54		R-3/2	6	191		Post firing, light incision, Chocolate slip
55		R-3/2	7	191		Post firing, light incision, wash, Red Ware
56		J-7/1	7	190		Post firing, light incision, wash, Red Ware
57		M-5/2	9	190		Post firing, deep incision, Chocolate slip
58		M-5/2	9	185		Post firing, deep incision, Chocolate slip
59		N-11/4	6	184	Dish	Post firing, light incision, wash, Red Ware
60		N-10/1	6	183		Post firing, light incision, wash, Red Ware
61		N-5/1	10	180		Post firing, deep incision, slip, Grey Ware
62		N-5/2	9	179		Post firing, deep incision, wash, Red Ware
63		N-5/1	10	178		Post firing, light incision, Chocolate slip

64		M-11/1	5	175		Post firing, light incision, wash, Red Ware
65		N-5/2	10	175		Post firing, light incision, Wash, Red Ware
66		N-10/3	6	174		Post firing, light incision, Chocolate slip
67		L-5/1	8	169		Post firing, light incision, Wash, Red Ware
68		J-7/1	1 S.B.6	170		Post firing, light incision, Wash, Red Ware
69		R-3/2	6	165		Post firing, light incision, Wash, Red Ware
70		R-3/2	6	165		Post firing, light incision, Chocolate slip
71		R-3/4	6	165		Post firing, light incision, Wash, Red Ware
72		J-7/1	6	164		Post firing, light incision, Wash, Red Ware
73		M-6/4	7	161		Post firing, light incision, Wash, Red Ware
74		R-3/4	6	160		Post firing, light incision, Wash, Red Ware
75		P-11/1	6	155		Post firing, light incision, Wash, Red Ware
76		M-10/ 2+3	1 S.B. 1	153		Post firing, light incision, Wash, Red Ware
77		M-10/3	5	153	Handi	Post firing, light incision, Wash, Red Ware
78		M-10/ 2+3	1 S.B. 1	155		Post firing, light incision, Wash, Red Ware
79		N-11/4	5	152		Post firing, light incision, Burnish, Grey Ware
80		N-11/2	6	152		Post firing, light incision, Wash, Red Ware
81		M-10/1	3	157		Post firing, light incision, Wash, Red Ware

82		P-11/4	6	151		Post firing, light incision, Wash, Red Ware
83		K-3/2	8	151		Post firing, light incision, Wash, Red Ware
84		K-3/2	8	149		Post firing, light incision, Wash, Red Ware
85		P-11/2	6	148		Post firing, light incision, Slip, Grey Ware
86		R-3/4	1 S.B.2	146		Post firing, light incision, Wash, Red Ware
87		R-3/4	1 S.B.2	146	Jar	Post firing, light incision, Wash, Red Ware
88		R-3/2	5	145		Post firing, light incision, Slip, Red Ware
89		R-3/2	5	145		Post firing, light incision, Wash, Red Ware
90		R-3/2	5	145		Post firing, light incision, Chocolate Slip
91		P-11/2	6	142		Pre firing, light incision, Wash, Red Ware
92		J-6/4	4	140		Post firing, light incision, Buff Slip
93		R-3/4	6	140		Post firing, light incision, Wash, Red Ware
94		N-11/3	5	140		Post firing, light incision, Wash, Red Ware
95		L-5/1	10	139		Post firing, light incision, Chocolate Slip
96		M-6/4	6	138	Vase	Post firing, light incision, Wash, Red Ware
97		M-6/4	6	140		Post firing, light incision, Wash, Red Ware
98		N-11/1	6	136	Pot	Post firing, deep incision, Chocolate Slip
99		R-3/4	1 S.B.1	132	Pot	Post firing, light incision, Wash, Red Ware
100		R-3/4	1 S.B.1	132	Jar	Post firing, light incision, Wash, Red

						Ware
101		R-3/2	5	130	Lota	Post firing, light incision, Wash, Red Ware
102		R-3/4	1 S.B.2	130		Post firing, light incision, Wash, Red Ware
103		R-3/4	5	128		Post firing, light incision, Chocolate Slip
104		J-7/1	1 S.B.1	126	Basin	Post firing, deep incision, Wash, Red Ware
105		P-11/3	5	126		Post firing, light incision, Wash, Red Ware
106		M-12/1	2 S.B.1	125		Post firing, light incision, Bichrome Ware
107		K-3/2	8	125		Post firing, light incision, Wash, Red Ware
108		R-3/2	1 S.B.2	125	Pot	Post firing, light incision, Wash, Red Ware
109		R-3/2	1 S.B.2	125		Post firing, light incision, Wash, Red Ware
110		L-10/3	1 S.B.2	121		Post firing, light incision, Chocolate Slip
111		R-3/2	2 S.B.2	120		Post firing, light incision, Chocolate Slip
112		N-10/4	4	120		Post firing, deep incision, Chocolate Slip
113		J-6/4	3	116		Post firing, light incision, Wash, Red Ware
114		M-10/4	1 S.B.1	116		Post firing, light incision, Wash, Red Ware
115		M-5/2	4	115	Basin	Post firing, light incision, Slip, Grey Ware
116		R-3/2	1 S.B.3	115		Post firing, deep incision, Wash, Red Ware
117		M-10/3	2	115		Post firing, light incision, Wash, Red Ware
118		M-11/2	4 S.B.3	114		Post firing, light incision, Wash, Red

						Ware
119		M-10/3	3 S.B.3	112		Pre firing, deep incision, Wash, Red Ware
120		J- 4/2	1 S.B.1	114	Dish-on-Stand	Post firing, light incision, Chocolate slip
121		J- 6/4	2 S.B.3	110		Post firing, light incision, Chocolate slip
122		J-5/3	3	110		Post firing, light incision, Slip, Reserve Slipped Ware
123		L-6/1	8	108		Post firing, light incision, Wash, Red Ware
124		M- 10/4	3	109		Post firing, light incision, Chocolate slip
125		J-6/2	2	107		Pre firing, light incision, Wash, Red Ware
126		R- 3/2	1 S.B.2	100		Post firing, deep incision, Chocolate slip
127		J-5/1	4	98	Basin	Post firing, light incision, Wash, Red Ware
128		J-5/1	4	98		Post firing, light incision, Wash, Red Ware
129		J-6/4	3	97		Pre firing, light incision, Wash, Red Ware
130		M- 10/3	3	98		Post firing, light incision, Chocolate slip
131		J- 6/ 1+4	3	96		Post firing, light incision, Chocolate slip
132		M- 10/3	1 S.B.2	95		Post firing, light incision, Chocolate slip
133		M- 10/3	1 S.B.2	97		Post firing, light incision, Wash, Red Ware
134		M- 10/3	1 S.B.2	99		Post firing, light incision, Wash, Red Ware
135		M- 10/3	1 S.B.2	101		Post firing, light incision, Wash, Red Ware

136		M-7/1	7	95	Handi	Pre firing, deep incision, Wash, Red Ware
137		R- 3/2	1 S.B.2	92		Post firing, light incision, Wash, Red Ware
138		K- 3/2	6	95	Jar	Post firing, light incision, Wash, Red Ware
139		P- 11/2	3	91		Post firing, light incision, Wash, Red Ware
140		R- 3/4	4	90		Post firing, light incision, Wash, Red Ware
141		M- 10/3	2 S.B.2	88		Post firing, light incision, Wash, Red Ware
142		X- 5/2	3	86		Post firing, deep incision, Wash, Red Ware
143		K- 4/2	5	83		Post firing, light incision, Wash, Red Ware
144		J- 6/4	4	80		Post firing, light incision, Red Slip
145		M- 10/2	1 S.B.1	80		Post firing, light incision, Wash, Red Ware
146		M- 10/2	1 S.B.1	85		Post firing, light incision, Wash, Red Ware
147		H- 6/3	2 S.B.2	80		Post firing, light incision, Chocolate Slip
148		A- 3/2	3	80		Post firing, light incision, Slip, Grey Ware
149		J- 5/3	4	80		Post firing, light incision, Wash, Red Ware
150		M- 6/4	3	78	Jar	Post firing, light incision, Wash, Red Ware
151		M- 6/4	3	80	Lota	Pre firing, deep incision, Wash, Red Ware
152		M- 10/3	1 S.B.2	77		Pre firing, deep incision, Wash, Red Ware
153		H- 7/3	3	82		Post firing, light incision, Wash, Red Ware

154		K- 3/1	6	75	Pot	Post firing, light incision, Wash, Red Ware
155		L- 10/3	3	109		Post firing, light incision, Wash, Red Ware
156		M- 11/2	1 S.B. 3	75		Post firing, light incision, Wash, Red Ware
157		M- 7/1	6	74	Lota	Post firing, light incision, Wash, Red Ware
158		J- 5/1	5	72		Post firing, light incision, Wash, Red Ware
159		K- 4/2	5	70		Post firing, light incision, Wash, Red Ware
160		M- 7/2	1 S.B. 1	70		Post firing, light incision, Wash, Red Ware
161		K- 4/2	5	70	Pot	Post firing, light incision, Wash, Red Ware
162		K- 4/1	3	75	Lota	Post firing, light incision, Wash, Red Ware
163		K- 4/1	3	70		Post firing, light incision, Wash, Red Ware

Graffiti Marks on Other Materials

Although the most popular canvass for engraving the graffiti marks was potsherds / clay vessels but occasionally these marks were also engraved on other materials such as terracotta cake, bone, beads, metal pieces etc. and the evidence of which are also found during the excavations at Rakhigarhi. Their details are given below:

Terracotta Cake – The terracotta cakes having the graffiti marks are similar to normal T.C. cakes comprises triangular, oval and circular shape. The graffiti marks are engraved only on one side while the other side is plain. These cakes are well fired and most of the marks are engraved before the baking of the cakes. It may be due to their use in religious rituals. Unfortunately most of the terracotta cakes containing

graffiti marks are broken and very few are intact. The detail of some of these cakes is as follow:

1. Oval shaped cake, from RGR -1(trench H-5/3).Mature Harappan level. The graffiti is engraved with the help of three strokes, forming the cross mark in which the right upper half stroke has another parallel stroke.
2. Broken cake probably triangular shaped, from RGR-2 (trench S-19/1). Mature Harappan level. Graffiti mark is engraved with the help of six strokes in which the both ends of two long parallel slanting strokes are suspended with two small strokes.
3. Triangular shaped, from RGR-2(trench V-18/1). Mature Harappan level. Graffiti mark is in the form of a small vertical stroke.
4. Probably circular shaped, from RGR-1 (trench U 18/1). Mature Harappan level. Deeply engraved graffiti mark showing close similarity with a sign of Harappan script, forming the shape of an arrow head.
5. Probably triangular shaped, from RGR-1(trench H-7/1). Mature Harappan level. This graffiti mark seems to be incomplete and the remaining part has two strokes in which a slightly curved horizontal stroke is resting over a vertical stroke.
6. Shape not identified, from RGR-1 (trench H-7/2). Mature Harappan level. Deeply engraved graffiti mark resembling to a sign of Harappan script which is similar to the cross mark with a small horizontal stroke attached to the right upper end.
7. Shape not identified, from RGR-2 (trench W-18/1). Mature Harappan level. 3 cm thick this cake is well fired. The light incision graffiti mark is in the form of three vertical strokes and engraved after baking the cake.

Metal – Although, the excavations have revealed several types of metal such as gold, silver, copper, lead etc., but the evidence of graffiti mark is found only on a lead piece. This semicircle lead piece has been found from the Mature Harappan level of mound RGR-2 (trench Q-19/4). The graffiti marks can be seen on its both sides – one side having the graffiti of six strokes in which five are in a row and the sixth is below this row. It shows close resemblance with a sign of Harappan script. The other side of the lead piece contains the graffiti of eight strokes in which two are similar. The exact purpose of this piece can not be determined but it seems that it might have been used as a seal.

Bone – Two small and thin bone pieces have revealed the evidence of graffiti marks. Both the pieces have been found from the Mature Harappan level of mound RGR -2 (trench Y 24/4). On the first specimen, the light incision graffiti mark is in the form of multiple sign and a part of semicircle attached to its right side. It is similar to a sign of Harappan script.

The second is polished specimen and on its one side the graffiti marks are engraved as seven signs, similar to the Roman letter I N and X. I and X sign are used three times while N has been used only one time (INIXIXX). These three signs also show close resemblance with the letters of Harappan script.

Beads – Different type of beads made on terracotta and semi-precious stones such as Lapis Lazuli, Carnelian, Agate, Jasper, Steatite, Faience etc. are found in good number at Rakhigarhi. Among them graffiti marks are found only on terracotta beads. There are two examples of such type of beads and both are obtained from the Mature Harappan level.

The first specimen is found from the mound RGR-1(trench K-3/2). This annular shape bead is 2.1cm long and its diametre is 5.6 cm. The marks engraved on it are similar to the symbol of tree.

The second specimen is also annular in shape and found from the mound RGR-2. It is 2.9 cm long with a diametre of 3.8 cm. Its graffiti mark represents an oval outline inside which several horizontal strokes in upper part and a cross sign at its base is engraved.

Method of Execution

It seems that there was no any specialized technique for the engraving of graffiti marks and it was executed by any pointed implement either in pre-firing stage or in post firing stage. However, on the basis of minute study of the nature of engraving it can be said that two types of implements might have been used:

1. Fine pointed implements
2. Normal edged implements

Graffiti marks engraved by the fine pointed implements are usually uniform and show consistency. These type of tools were probably made of stone or metal and mostly used for engraving the post firing graffiti marks because after firing the surface of pot became hard and it will difficult to scratch the marks by normal implements.

The implements belong to second category most probable consisting bone or wood points which might have been used for the engraving of graffiti marks in pre firing stage. Due to leather hard condition the engraving becomes easy and there is no need of using any specific tools. The graffiti marks engraved by the normal implements are usually not uniform.

Location of Graffiti Marks on the Vessels

Although, there is no any specific place/part of the vessels on which the graffiti marks have been engraved. These are engraved on any part of the vessels but on the basis of their availability it can be divided in following categories: (a) Rim (b) Neck (c) Belly (d) Between base and belly and (e) Base. Among these the graffiti marks are mostly engraved on belly

portion because it is easy to engrave on protruding part. The second popular part of vessels for engraving graffiti marks is rim. On this part mostly those graffiti marks have been engraved which are in form of vertical or horizontal of slanting strokes. The third favourite part for engraving is the base and most probably might have been the potter marks. It is significant that the graffiti marks found on rim and base are mostly scratched in pre firing stage and are comparatively broad and deeply engraved. This may be due to because these are the thickest part of the vessel and despite of deep engraving the durability of pot does not affected. The graffiti marks on the belly and neck portion show similarity with the sign of Harappan script, thus it can be presumed that these may be the owner's name.

There are few examples in which the graffiti marks are engraved on the interior of the vessels but in that case the mouth should be widely opened which resulted more exposed interior. The best example of this category is dish, dish-on-stand, basin and bowl. There are few examples also in which both exterior and interior of vessels having the graffiti marks. In these examples it has been observed that the interior graffiti is engraved before the firing while the exterior graffiti is engraved as post firing activities which may indicate the potters name and owners name respectively.

It can be said that the Harappan graffiti can not be explained on a single line. It is quite possible that its engraving may have several objectives depending on the nature and location of graffiti marks. Sometimes it may be engraved as potter's name or owner's name or exhibits artistic senses. The graffiti marks obtained from Rakhigarhi indicate towards its probable use in Harappan script. The graffiti marks recovered from the Early Harappan level (RGR-6, RGR-1) having less signs similar to the Harappan script but contrary to this the Mature level (RGR-1, RGR-2) yielded good no of potsherds/ T.C. cakes with graffiti marks very similar to the sign of Harappan script.

Chapter 9

Terracotta Objects

The Terracottas are not simple object to study art but they also throw light on the religious life of the people. Proto-history, Harappans are identify with a typical characteristic lifestyle which was uniform over large geographical area in terms of town planning, Ceramic assemblage, metal object, use of semi-precious stone and Terracottas. The Harappan Terracottas represent contemporary religious, social beliefs, economic and technological advancements as well amusement objects, toys for the young ones as well human emotions.

The main features of terracotta figurines found at Rakhigarhi are as follows:-

1. The early Harappan Period is characterized by bull terracotta figurines. Where as the Mature Harappan period is marked by various animals, human, bird and other type of Terracottas.
2. The early Harappan bulls have different characteristic features than the mature Harappan bulls. But, evolution of Bull figurine is visible as early and mature Harappan Terracottas share common features of Harappan Terracottas.
3. The typical Harappan 'Mother goddess' figurine which is characteristic feature of Terracottas from Indus Valley is missing at Rakhigarhi. The similar feature is noticed in all Harappan sites in Ghaggar – Drishadvati divide.
4. The street area of RGR-1 has revealed more number of Terracottas.
5. The RGR-2 mound has revealed more variety of terracotta objects. The male torso is found on podium of RGR-2.

6. The buffalo terracotta figurine share common characteristic feature with the buffalo Terracottas found at Harappan and Mohenjodaro. At Rakhigarhi they are found from layer No. 12 onwards. The more number of Buffalo figurines suggest that sedentary pastoralism & milk production was a separate economic activity.
7. The maximum number is of bull terracotta figurines. It was certainly an important animal for agriculture, for transportation (of trade goods as well) and certainly played a vital role in the religious life of the Harappans.
8. The dog figurine are found from layer (11) indicates that dog was not among demonstrated animal in early and formative phases of Rakhigarhi.
9. The cow figurine is obscurely missing.
10. The mechanical toys show creativity and source of human of Harappans.



Pl.1. Human figurines from Rakhigarhi





Pl.2 Animal Terracotta Figurines, Mature Harappan



Pl.3 Animal Terracotta Figurines, Mature Harappan



Pl.4 Animal Terracotta Figurines, Mature Harappan

Chapter 10

Copper Objects

The metal objects found at Rakhigarhi are essentially made of copper. The chemical analysis of these objects is still in progress; hence details about the chemical components are not known yet. But typologically these objects can be divided into following category:

a. Tools and weapons

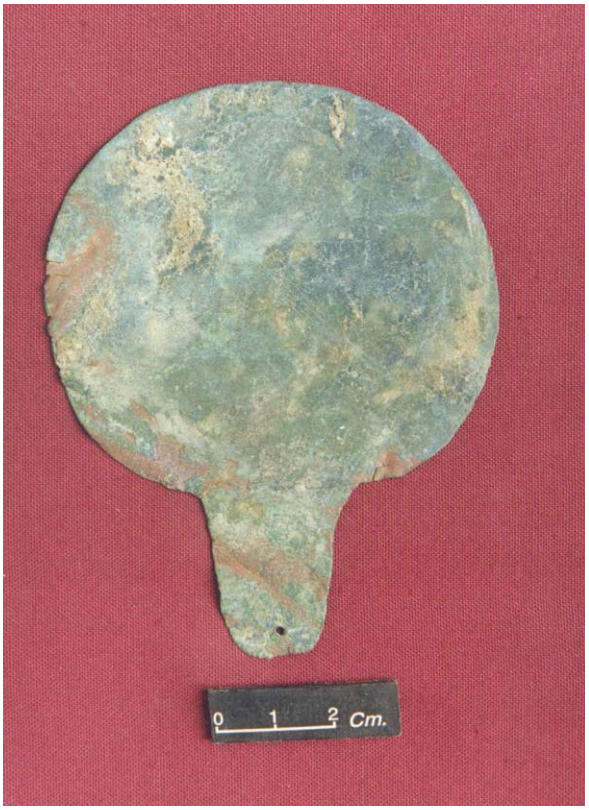
b. personal ornaments

c. miscellaneous

The use of metal objects is noticed from the Early Harappan levels but it becomes common during the Mature Harappan period:

A. Early Harappan: (1) Tools and weapons include arrow-heads, chisel, stylus, needle etc. (2) Personal ornaments include bangles and spiral ring.

B. Mature Harappan -In this period arrow-head, knife, chisel, nails and balance-bar and stylus are found. Ornaments like bangles, ring, antimony-rod, pin etc. are found. Among the miscellaneous objects buckle, clip, inlays, disc, beads are reported. Gold fillet and beads, silver bangles are also reported from the excavations but they are very few in number. Among the metal objects copper articles are dominant. The details of which are given in the following table:-



Pl.1 Copper Mirror, Mature Harappan period.



Pl.2 Copper Object, Mature Harappan period

Chapter 11

Harappan Bead Industry

The first evidence of Indus Civilization was discovered in the early 1920's and the designation "Harappan Culture" was given after the name of the site. "Harappa" situated in district Montgomery in Pakistan, where its distinctive characters was first recognized. During the seventy five or more years since then, our knowledge of this civilization has expanded phenomenally, due to continuous excavation and exploration work carried out by the concerned authorities' refinements in the methods of technique as well as the new interpretation of the evidence. This improved understanding covers almost all aspects of the civilization and as a result, we now have a better understanding of the origin growth and decline of the Indus civilization. Three stages in this process are recognized. These are Early Harappan, Mature and Late Harappan.

A. Distribution of Beads in different Harappan sites:-

Like other industries or crafts the evidence of use of beads by the people or their manufacturing centers came from very beginning. From many Early Harappan sites, beads made of different materials were discovered in abundance. It suggests that the lapidary industry well flourished during the early developmental phases of the Indus Civilization. Mackey has rightly remarked that there is every possibility that in India, bead making was one of the most ancient art since in most places the requisite material were ready in hand. The importance sites from where different types of beads were unearthed are as follow:

EARLY HARAPPAN SITES

As many as fifty sites, related to Early Harappan settlement has been excavated so far, in both India and Pakistan (also in Afghanistan) from these sites, different type of beads were discovered, which were made of various materials and having different shapes and sizes.

1. Mehargarh:-

In Mehargarh, the structural remains of a bead manufacturing workshop was excavated, where steatite was cut and worked into beads. Apart from the large number of flakes, unfinished bead, steatite small fragments of lapis-lazuli, tarquoise, carnelian and other semiprecious stones together with drills made of flint stone were also discovered from this place. Mehargarh must be a very important Early Harappan site from where we find the earliest example of a well established beads manufacturing centre.

II. Bhut-Shamsi:-

Situated in central Baluchistan the site of Bhut Shamsi has yielded beads of carnelian in good number.

III Jagjai:-

This is a small Early Harappan site from where numbers of beads made of precious Lapis-lazuli were found. May be this site gets the stone from Afghanistan which was not far away.

IV. Nal:-

Situated in southern Baluchistan, Nal was a very important site as per as beads was concerned. Beads of semi precious stones like Carnelian, Agate, Lapis-lazuli and marine shell were discovered from this

site. Hargreaves found several strings of beads composed of entirely disc and cylindrical shaped lapis-lazuli. Probably, this stone came to Nal from Persia.

V Balakot:-

From Balakot beads of shell have been discovered. It was a major manufacturing centre for shell objects including beads in Harappan times.

VI Lewan:-

Beads of steatite, shell and semi precious stone were discovered from this site.

VII Tarakai Qila:-

This site has been yielded beautiful beads of lapis-lazuli.

VIII Sarai Khola:-

From this site, beads of steatite and carnelian, Agate, Jasper, Lapis-lazuli and turquoise discovered from Early Harappan strata.

IX. Rehman Dheri :- (upper Indus plains)

Rehman Dheri was an important centre for bead manufacturing. As there was a presence of unfinished beads of Lapislazuli, turquoise, agate, lumps of raw precious and semi precious stones. From Rehman Dehri at least 20 drill heads were found intact inside the attempted hole of an unfinished carnelian beads.

X Gumla:-

From Gumla different type of beads made of semi precious stones like agate, carnelian and lapis-lazuli were excavated. This site was excavated by A.H. Dani in 1970-71.

XI Jalilpur:-

Jalilpur is located on the former plain of the river Ravi. The lapidaries of Jalilpur used different type of raw materials for the making of the beads which include beads of shell. Lapis-lazuli, carnelian,agate, chert, copper and gold. All this materials were imported from outside.

XII Jhang:-

This site was important for the accurance of agate beads.

XIII Amri:-

The settlement of the Early Harrappan Period was first notice at Amri by Majumdar in his excavations of 1929. This site is situated on the bank of river Indus, opposite Chanhu-daro, 130 km south of Mohenjo-dero. From Amri, different type of beads has been collected including beads of lapis-lazuli.

XIV Ghazi Shah:-

Ghazi Shah is situated in southern Sindhi. Beads of steatite, agate and carnelian have been discovered from this site.

XV Gorandi:-

This site is also lies in southern Sindh and from this site, an unfinished bead of carnelian were excavated. May by this site was manufacturing centre for carnelian beads or used by the lapidaries as a market place.

XVI Pandi Wahi:-

The site of Pandi Wahi has been yielded beads of steatite and lapis-lazuli.

XVII Kot Dizi:-

This site is situated in upper Sindh valley. Beads made of marine shell have been found from the site. Kot Dizi was excavated by F.A. Khan kuring 1955-57.

XVIII Kalibangan:-

Kalibangan is situated in Rajasthan and lies in the Ghaggar-Hakra plain. From this site, beads of shell, steatite, carnelian and agate were collected. May be marine shell came from Sindh coast to Kalibhangan. At the same time certain basic, raw materials such as steatite and cryptocrystallin silica stone like agate and jasper were being procured from the other parts of Rajasthan.

XIX Banawali:-

Banawali is lies in the drainage system of Sarasvati-Drishdvati Rivers and was excavated by Mr. R.S. Bisht in 1974. Beads of steatite, agate and carnelian were discovered from this site.

XX Rakhigarhi:-

Rakhigarhi is situated in district, Hissar Haryana and like Banawali, lies in the drainage system of Sarasvati-Drishdvati rivers. From these site beads of steatite and semi precious stone like carnelian, agates and jasper were unearthen.

Mature Harappan Sites

The distribution of Harappan sites indicates that total 917 are present in India, 481 in Pakistan and 1 in Afghanistan. Among this sites hundreds of sites has been excavated so far. Like in Early Harappan sites, the evidence of beads either in manufacturing process or finish product, were collected from mature Harappan. Mainly these excavated sites were situated on the bank of Indus and its tributary Hakra or

Ghaggar rivers and Makeran coast. Ruper in north, Bhagtravin south, Alamgripur in east and Sutkagendor (Afghanistan) in west decided its outer limits.

Some important Harappan sites from where beads has been collected, were as follows:-

1. **Mohenjo-daro:-**

Mohenjo-daro is one of the most important sites of Indus valley civilization situated in the bank of river Indus in the Larkana district, Pakistan. It was excavated first of Sir John Marshall and Mackay from 1922-31 and again by Wheeler. All type of beads made of different materials have been collected from this site in a large quantity. The lapidaries of Mohanja-dero used each and every material for the making of beads. Among them, beads of steatite, shell, carnelian, agate, jasper, jade, lapis lazuli and metal were discovered so far which are very important for the study of beads.

II Chanhu-daro:-

In Mature Harappan period, Chanlu-daro seems to be the largest bead manufacturing centre. The evidence of bead making was of three type-different type of tools and small implements like drills which has been found in broken and unbroken form in significant quantities beads tools etc. Lumps and nodules of agates, amethyst, transparent white crystal, carnelian and the presence of unfinished beads in abundance. Among finished product beads of steatite, shell, semi precious stones and Metal have been collected from this important site.

TABLE 1

DISTRIBUTION OF STONE BEADS IN INDUS CULTURE

Serial No.	Material	Chanhudaro	Harappa	Mohanjo-daro	Lothal	Rakhigarhi
1.	Agate	X	X	X	X	X
2.	Amazone	X		X		X
3.	Amethyst			X		
4.	Charnelian	X	X	X	X	X
5.	Chalcedony		X			X
6.	Chert		X		X	X
7.	Crystal			X	X	X
8.	Feldspar		X	X	X	X
9.	Flint					X
10.	Haematite					X
11	Hormblende	X		X		X
12.	Jasper	X	X	X	X	X
13.	Lapis-lazuli	X	X		X	X
14.	Marble		X			
15.	Monoclline		X			
16.	Onyx	X		X	X	
17.	Opal					X
18	Quartz	X				X
19.	Serpantine		X	X		X
20	Steatite	X	X	X	X	X
21	Turquoise			X		X
22.	Breecia	X	X	X		
23.	Faience	X	X	X	X	X
24.	Paste	X		X		X
25.	Vitreous paste	X		X		

III Jhukar:-

This site is situated in southern Sindh. From here beads of steatite, Jasper and Lapis-lazuli were collected in good number.

IV. Lohunj-daro

The site of lohunj-daro has yielded beads of steatite, carnelian and feldspar.

V Amri:-

In Early Harappan Period beads of semi precious stones were found in Amri. But after the decline of this culture, very rare evidence was present and only steatite beads were collected from this site, May be the non availability of raw material was the major cause for this.

VI Allhadeno:-

This site is also situated in southern Sindh. From this site beads of Steatite of different shapes and sizes were unearthened. The site was located 25 km east of Karachi and was excavated by Fairservis and Shaffer since 1973.

VII Harappa:-

Harappa is very important site for the availability of beads located incentral Indus plain on the left bank of the river Ravi. Different type of beads have been found in Harappa both in finished and unfinished state, which indicates that beads of semi precious stones like agate, carnelian etc were locally manufactured. Associated tools and implements were also collected. Beads of ivory, seatite, agate, jasper, jade, lapis-lazuli and other semi precious stones were found in large quantities along with metal beads.

VIII Gumla

This site has yielded beads of steatite and semi precious stones like Carnelian, agate, jasper and Lapis-lazuli.

IX Rehman Dheri:-

From this site, beads of carnelian were collected. Etched carnelian beads of different varieties were found.

X Kot Diji:-

This site alos yielded different type of carnelian beads all in finished stage.

XI Kalibangan:-

Kalibangan was the major site from where beads of steatite, carnelian, agate, jasper and metal were collected. The site lies along the left bank of Gaggar (Ancient Sarasvati) in the northern part of Rajasthan and systematically excavated between the year 1961-69 by Dr. B.B. Lal. And A. Ghosh.

XII Banawali:-

From Banawali, beads of different material like steatite, shell, carnelian, agates, lapis-lazuli has been excavated. Beads made of metal were also collected.

XIII Rohira:-

The site of Rohira is situated near Banawali. Rohira was a bead manufacturing centre, which has yielded beads of carnelian of different shapes and micro beads of pure gold.

XIV Raper:-

This site was located at Ambala district in Punjab and lies on the ancient bank of river Sutlej. Beads of steatite, carnelian and agate were discovered from this site.

XV Kotla Nihang Khan:-

From this site beads of marine shell and carnelian were collected. This site is also situated in Punjab state.

XVI Mitathal:-

Mitathal is an important bead manufacturing centre in Mature Harappan times. Presence of an unfinished agate beads as well as core indicates that the lapidaries of Mitathal brought raw material for the making of beads especially semi precious stone from Rajasthan and then with the help of different small tools and implements, they manufactured various type of beads within the site. From this site, steatite beads were also collected in good quantity.

XVII Rakhigarhi;-

From this largest Harappan, site beads of steatite and all semi precious stones like agate, carnelian, jasper, quartz, lapis-lazuli, sodalite (an emitation of lapis-lazuli) turquoise, hornblende etc were collected in abundance. Some structural remain indicates that stone beads like carnelian was locally manufactured by the lapidaries of Rakhigarhi. Etched carnelian beads were also found in good number.

XVIII Dher Majra:-

Dher Majra, where 1200 beads were recovered on the surface and in the execution conducted by Prufer (1951), was an important centre for bead manufacturing. Majority of finished bead were of agate. A number of unfinished beads some partially perforted, others only sparingly shaped were noted. The vast diversity of beads and the unfinished specimens which testify to the various stage of bead manufacturing, these provide evidence of local production of beads at this site it self.

XIX Balu:-

This site has yielded beads of steatite.

XX Lothal:-

Lothal is one of the most important Harappan site which lies in Surashtra region of Gujarat. It was a major manufacturing centre of steatite beads which was proved by the presence of large number of steatite beads carnelian which were found embedded in the bead factory. A large dump of dehydrated lime which was found near kiln inside this bead factory is very important. May be this lime was used for dehydrating steatite stone here. Beads of shell, Ivory semi precious stones and metal were also collected in good quantity.

XXI Rangpur:-

Rangpur is situated at Surendra nagar in Ahmadabad dist of Gujarat From this site beads of steatite shell, Ivory, semi precious stones and metal were collected, having different shapes and sizes.

XXII Surkatada:-

This important site is situated at Kutch (Gujarat) and excavated by J.P. Joshi. In Surkotada, semi precious stone like agate was locally available. An area of about 200 m away from the main mound, which was strewn with nodule of semi precious stones, wasted fluted cores were found. May be was a major site, where beads manufacture was undertaken.

XXIII Nagwada:-

Nagwada is situated at the district Surendra nagar Gujarat. From this site bead of steatite and agate were collected. Evidences show that shell beads were locally manufactured here.

XXIV Nageshwar:-

From this site beads of steatite and carnelian were excavated which were of different shapes and sizes.

XXV Bhagatrav:-

Bhagatrav has yielded beads of steatite and carnelian. May be these beads were locally manufactured by the lapidaries of Bhagatrav.

LATE HARAPPAN SITES

The term “Late Harappan” in general has a specific chronological and cultural connotation Chronologically, it denotes the phase immediately follow the Mature Harappan phenomenon in the 2^{nd} millennium B.C Culturally it has came to be associated with a Late phase of Harappan civilization, its assemblages bearing a stylistic debt to the civilization which include the presence of writing certain similarities in the shapes and the form of beads and the painted designed etc.
Important sites from where different type of beads was collected are as follow:-

1. Harappa:-

In Harappan, during the devolution phase of the Indus civilization, evidence show decline in the bead industry which flourished between 3^{rd} and 2^{nd} millennium B.C. Beads of steatite, agate and gold were recovered from the Harappan in a small quantity.

II Lohunjo-daro:-

From this site beads of steatite and carnelian has been reported.

III Dadheri:-

The site of Dadheri is situated in the Indo-gangatic plain Beads of semi precious stone like carnelian and lapis-lazuli were collected.

IV Daulatpur;-

From Daulatpur beads of steatite was discovered.

V Hulas:-

Hulas is situated at Saharanpur Dist in Uttar Pradesh. This site was excavated by Shri K.N. Dixit in between 1978-83. Beads of carnelian and agates were recovered from this site.

VI Balu:-

This site has yielded beads on steatite, carnelian and agates.

VII Bara:-

From this site, beads of steatite of different shapes and sizes, carnelian agate and metal beads were collected. This site was excavated by Mr. R.S. Bisht.

VIII Mitathal:-

Like Mature Harappan Period, in the Late Harappan Period too Mitathal maintain its importance in the field of bead manufacturing. The lapidaries of the site make beads of different semi precious stones in large quantity. They import agate stone from Rajasthan for the making of beads as well as beautiful carnelian and precious lapis-lazuli from Afghanistan.

IX Daimabad:-

Daimabad is situated in the dist Ahmadnagar, Maharastra. This site is very important for the study of the Deccan Chalecolithic culture.

Here, we find a well developed Late Harappan settlement Apart from other antiquities, beads of ivory, semi precious stones and Metals were collected from this site.

X Lothal:-

Like Mitathal, Lothel also maintained its status as a bead production centre. From this phase incomplete perforated agate beads has been found. Beads of steatite, shell and other semi precious stones also were found.

XI Rangpur:-

From this site beads of steatite, ivory, carnelian agates and jasper were excavated.

XII Rojdi:-

Rojdi is situated in dist Rajkot. Gujarat and was excavated by Possell between 1983-85. Beads of steatite, shell and carnelian were discovered form this site.

XIII Somnath:-

This site has yielded beads of steatite, shell, carnelian and jasper.

XIV Ratanpura:-

This site is very famous for its collection of finished stone beads. Beads made of almost all available material were collected, in which beads of steatite, shell and carnelian were also included.

XV Sanghol:-

This site is situated in district Ludhiyana, chandigarh. From this site, evidences of Late Harappan, “Bara culture” was found. From

Sanghol associated antiquities, beads of steatite and semi precious stones were found in good quantity.

After a very brief survey of some important sites which were related to Harappan sites, one can easily say that the lapidaries of Indian sub continent had well utilized the available raw material and if required they use to import raw material from other places also with the aim to show their artistic skill in the manufacture, of different type of beads. They even established their production at those centre, which could be a well market place or making a trade network within the region using their communication as well as trading skill.

B. Type of Raw Materials

The lapidaries of Indus valley used different type of raw material for the manufacturing of beads which were collected from various part of India as well as from Afghanistan and central Asian countries. For this purpose many bead manufacturing centers were established and these centre acted as a major place for disturbution of finished products even out side their periphery. Beads manufactured by Indus lapidaries were also discovered from the Kish, Sumer, Ur. Etc.

Semi Precious stone:-

From many Harappan sites, beads has been discovered in a varieties of semi precious stone such as jasper agates, onyx, amozon stone, plasma, lapis Lazuli, chalcedony, sodalite, quartz, brerccia, serpentine, turquoise, and haemitate. All these stones might have been obtain from various parts of India, Afghanistan and Baluchistan. Usually the Indus lapidaries

exhibited a keen effort in selecting the good material from the wide range of semi precious stones. Practically in stones beads, beads of every shape and sizes were use by the Harappan people. Some were of big size and made up of soft stone like limestone and Alabaster. Probably they serve as amulets the favorites material for beads were chalcedony, carnelian, steatite etc. May be the fine texture, pleasing colour and translucency of stone were important factor in the selection of raw material for the manufacturing of beads. Apart from this, natural patterns which were some time present in stone were equally very important. Also the commercial value of the stone depend upon its color and light its transmit.

Beads of agate stone was fairly common and show considerable variety of shape and colour and shape used in almost all major Harappan sites. The agate beads of Harappa and Sumer were circular and elliptical in section.

Harappan lapidaries produce beautiful carnelian beads by heating agate pebbles, and they were very common in Harappan sites. “Etched Carnelian” beads wer some what rare in terms of availability of this type of beads in majority. Severyal specimens has been discovered from Chauhu-dero, some were of same shape as found by Woolley in the Royal tombs of Ur. So, their presence in the Indus cities are important as a means of dating these cities.

Shell:-

Shell beads were very common in Harappan sites. These beads were usually discular in shape and white in colour. Shell beads were manufactured in coastal areas, where sea shell were found in abundance and then finished beads are distributed in other areas.

Ivory ad Bone:_

For a change, the Indus lapidaries some time used Ivory and bone for the making of different type of beads. The elegance and perfection found in these beads, were indeed the result of devotion and enthusiasm for creating and perfecting beauty that manifest itself through durability and usefulness of the object.

Faience:_

Faience bead were found in lower as well as upper level of Harappan sites. These bead were made by past which was prepared with quartz or steatite sand flux and a coloring agent are of different shape and colour. Faience beads of green, yellow, black, white and red colour have been collected from different Harappan sites. Beads of vitreous paste were manufactured through out the occupation of Mohenjo-daro.

Steatite:-

Steatite is a material which was most extensively used in Mohanja-daro. Harappan lothal, Chandhudero and other Harappan sites, I was known material in Egypt, Babilonia, Assayria and China. Three quarters of beads found at Mohanjo-daro either cut out of steatite stone or a moulded from a paste made of ground up stone. It is a very soft material (Massive form of tale), so it helps in carving.

Terracotta:-

A large number of terracotta beads have been found in course of excavation at different Harappan sites clay the material, used for making these beads was locally available. Their beads must have been for and worn by poorer class of the society.

C. Technique of manufacturing Beads

Beads manufacturing is one of the oldest craft skill of the Indus valley civilization. These Beads were made from semi precious stones shell, Metal or even terracotta. In early years, beads were made with simple technique using stone to cut shape and perforate relatively soft raw materials. Drilling was done with hardened copper drill or tapered cylindrical stone drill made from chert or jasper. These Beads making technique was very common through out the Indus region.

With the rise of the Indus sites beads making become highly specialized Industries, stone beads continued to be produced at many sites using the earlier technique, but in some larger town such as Harappan, Mohanjo-daro Chandudaro or Lothal, specialized bead making workshops began to make unique style of beads using new raw materials and new techniques of manufacturing . New method were invented to decorate stone beads and to made imitation of turquoise, agates or carnelian beads from artificial material such as faience of steatite.

Major factory sites;-

Many beads making factory sites were excavated so far related to Indus valley civilization. At Lothal a mud brick structure having an area of about 5000 sq meters with eleven rooms and a large courtyard was excavated. This was used as bead factory as well as store room. Two earthern jars one containing 600 finished carnelian beads and the other contain beads in various stages of manufacturing were found embedded in a mud bricks platform. In the courtyard two other pots were notice in the room west of the courtyard, which have an independence entrance and it is cut off from the courtyard and other rooms. The arrangement of

rooms, courtyard, passages etc reveals a high degree of planning in establishing this beads manufacturing centre. May be the worker lived in the rooms build around the working platform within the central courtyard. Besides finish and unfinished beads a circular kiln, having an opening in the north, for heating agate, pebble and finished carnelian beads was also excavated. A flanged drill meant for drilling was found in one of the room. So it was quite clear that this bead manufacturing factory was constructed in a very specialized form in lothal. In Chanhu-daro, a thirty three feet long and twelve feet six inch wide mud brick structure or building was excavated. Unfinished beads metallic an stones drills, ingots nodules were scattered inside this structure. From Shahr-I-sokhta located in the Iranian Sistan, a square biconical buff ware jar containing unfinished beads, cutting tools and three pieces of cane were collected. The canes used as a container for semi precious stones that had been roughly shaper and were ready for drilling. Seven carnelian beads and thirty five chips of carnelian and splinters of green chalcedony in different stages of manufacturing were found laying in one well made mud bricks platform. May be Shahi-I-Sokhta was a big centre for producing stone Beads.

CLASSIFICATION OF BEADS OF RAKHIGARHI

Rakhigarhi has yielded a large collection of beads of different material. Among the material mention may be made of steatite faience, semi precious stones like agate amozonite, carnelian, chalcedony, jasper, soapstone, lapis lazuli ivory, bone shell, copper, gold terracotta etc.

As mention earlier at Rakhigarhi six major areas RGR-1, RGR-2, RGR-4, RGR-5, RGR-6, RGR-7 were excavated. Except RGR-7, all the areas large number of beads have been covered. The present study is based mainly on 11421 beads collected from excavation during session 97-2000.

STEATITE:-

Steatite was the most popular material at Rakhigarhi for making beads. Three quarter of the total number of beads of the site was made of this material. Among the 11421 beads, 8407 beads were made of steatite. These beads have prepared by flaking the natural stone or by moulding steatite powder. Not only at Rakhigarhi, but at other Harapan sites for E.g Mohanjo-daro, Harappa, Chanhu-daro, Lothal and other sites too the fact of their majority keep its continuity.

TABLE –4

Percentage of steatite Beads found at Rakhigarhi

Session	Total No. of	Steatite	Percentage

	Beads		
97-98	5.306	4214	72.14%
98-99	3035	1986	65%
99-2000	3079	2217	72%

Important shapes:-

Disc:-

Out of 8407 steatite beads, 4190 beads were of disc shaped. This type of beads has been made by rolling the paste on a thread. They were pure white in colour very hard and were often found joined together. This connection is due to the pebble soil, which can be removed with the help of the needle.

Cylindrical:-

After disc shaped beads, cylindrical steatite beads came next in priority. These beads were divided into tow long cylindrical and short cylindrical. Method of making of these type of beads were same as disc beads.

Other important shapes in steatite were discular. Biconvex circular, Biconical truncated, tubular, globular, Etched, (Imitation of Carnelian) and discular beads with axial perforation.

TABLE –5

Shapewise Distribution of Steatite Beads.

Shapes	97-98	98-99	99-2000	Total
Disc	1243	1319	1628	4190
Long cylindrical	794	309	248	1351
Short cylindrical	1208	78	168	1454
Biconvex Circular	56	32	73	161
Elliptical		18	11	29
Discular	102	82	53	237
Tabular	55	10	6	71
Discular with Axial perforation	55	11	11	77
Globular		6	5	11
Etched	189	5	7	201

FAIENCE:-

Faience comes next in popularity. Beads of Faience has been made by rolling the past on a thread as traces of thread inside some the beads were visible. May be these beads were made in many beautiful

colours, but mostly they had lost their hue. At Rakhigarhi common shapes of this material were cylindrical, globular, elliptical, gadrooned, segmented etc.

TABLE –6

Percentage of Faience Beads found at Rakhigarhi

Session	Total	Faience	Percentage
97-98	5.306	392	7.3%
98-99	3035	477	15.72%
99-2000	3079	277	9%

SEMI PRECIOUS STONES;-

Agate:-

Agate bead making is a highly specialized craft that was practiced by artisans of Indus civilization, who were producing these beads primarily for trade and local consumption. It was considered to be highly prized stone due to its beautiful colour like white, yellow, brown and red. Commonly found shapes of agate were globular Elliptical and biconical truncated. Out of 356 beads of semi precious stones, 44 beads were made of agate.

Carnelian:-

Carnelian beads were considered to be very helpful in dating many Harappan sites, with the help of their shape and attractive design etched

on them. It was produce to red variety of veined agate. The lapidaries of Rakhigarhi producing beautiful carnelian beads by heating natural agate.

A good collection of carnelian beads has been recovered from Rakhigarhi, total 169 carnelian beads were collected from different trenches. Important shapes were barrel, biconvex circular, globular, cylindrical. Among them, long barrel bead of carnelian are very helpful in deciding chronology of any Harappan sites. Unfortunately, we haven't got not a single intact long barrel carnelian beads, but some broken barrel beads were noticed from the above mentioned bead manufacturing factory at RGR-1 length of this broken beads was about 1.2 cm and diameter was .6 cm. These type of carnelian beads were always made of translucent red agate. It proved by the Scholars that long barrel beads were manufactured in India only, were export to Mesopotamia.

Etched beads of carnelian collected from Rakhigarhi were etched with "Eye pattern", line pattern", "circle pattern", "Eight figured pattern" and "Chevron pattern". Among them, carnelian beads with figure of '8' was most popular and many of them have been collected from Rakhigarhi during the session 97-2000. These figure of eight were mostly empty, generally at Rakhigarhi etching was done with the help of plant juice leaving the design in white colour on red surface of stone.

Jasper:-

Total 39 Jasper beads were recovered from Rakhigarhi. Beads were made of different varieties of coloured, Jasper like green jasper banded with black white centre and chocolate ends, black white red veins red centre veined with white ends or brown ends olive green or brown colour jasper beads were remarkable. Majority of Jasper beads

were drum shaped (Biconical truncated) and well marked. We got one unfinished jasper bead as well as hundred of bed roughouts along with carnelian bead roughouts from beads factory located at RGR-1.

Lapis Lazuli:-

Beads of Lapis Lazuli were very numerous at Indus sites but from Rakhigarhi, we got only 19 beads of this material. Important shapes were short cylindrical and thick disc like other Harappan sites. The lapidaries of Rakhigarhi also imported this semi precious stone from Afghanistan. It was not so easy to get the material from the place located so far from Rakhigarhi, so lapidaries use Sodalite, which was easily available from the hill of Aravalis, on the place of Lapis Lazuli. Total 21 beads of this material were recovered from this site.

Turquoise:-

This stone was rarely used for making beads at Rakhigarhi only three beads of tarquoise were collected.

The people of Rakhigarhi also use (not locally manufacture) beads of amozonite, horneblende, serpentine, quartz, chert, crystal, and feldsper, Beads of these material were imported from outside and they were very few in number.

TABLE –7

Percentage of Stone Beads found at Rakhigarhi

Session	Total	Beads of semi precious stone	Percentage
97-98	5.306	112	2%
98-99	3035	120	3.45%
99-2000	3079	138	4.4%

Paste:-

Under this category those beads were included whose material were not identified. 169 paste beads were collected from Rakhigarhi have different shapes for E.g cylindrical, Biconical truncated, globular, tubular. Biconvex circular gadrooned, etc. They were found in different colour. Outer surface of paste beads were sometime glazed.

Shell:-

Beads of shell were not very common in Rakhigarhi. Usually marine shell was used for the making of beads, but we haven't found any roughout or debitage of required marine shell (special Gastropads) in Rakhigarhi, so it indicates that beads of marine shell was imported from coastal region. 47 shell beads were collected. Common shape were thick discular, biconvex circular, short cylindrical and elliptical.

Bone and Ivory:-

These two material has been sparingly use for making beads at Rakhigarhi. Bone was used for making awls pins tools and rarely for making beads. Total 20 bones and 3 ivory beads were collected. Majority of them were long cylindrical.

Terracotta:-

1170 terracotta beads of different shapes were found at Rakhigarhi. Fine levigated clay has been used for making beads, sometime they were moulded and treated with red slip. Mostly terracotta beads were barrel in shape but long cylindrical, Annular, biconical, ellipitical shapes were common. Spacers and pendants were made of terracotta were also collected.

Beads of terracotta were more popular in upper levels of Mature Harapan periods this may be due to decline in the over seas trade of Rakhigarhi.

Metal Beads:-

Beads made of gold and copper were very rare in Rakhigarhi only 19 gold beads and 18 copper beads were collected during session 97-2000. gold beads were generally thick discular, disc, Biconvex circular and tubular in shape and cylindrical biconical thick discular shape were very common in copper.

Spacer and Pandents:-

Apart from beads, we got different varieties of spacers and pendants also, which were very remarkable in their shape as well as making. Spacers were only found in terracotta, having maximum three perforation. They were very thin in section and some time well sliped. But pendants were made of different material like terracotta, shell and stone (feldspar). Some pendants were very beautiful. One terminal of

terracotta for joining two string of beads were also collected from Rakhigarhi.

BEADS ASSOCIATED WITH BURIAL

Just before the closing of the camp, we got steatite micro beads as well as gold beads with the burials, excavated at RGR-7. there beads were associated with three female burials. All beads were well perforated and polished. Steatite micro beads were laying right side of the neck and their position suggests that they were the part of a necklace placed around the neck as funerary object by the family members. This type of ritual practice was common in mature Harappan context outside Punjab-Harayana region.

Steatite micro beads collected from burial No. 3 & 11. Among them burial NO. 11 represents phase-I and burial No. 3 associated with phase-II of mature Harappan period. This evidence shows the continuation of religious belief of the people of Rakhigarhi. The orientation of skeletons, position of skull, all are same, but only on the basis of some pottery forms, these burials were divided into the different phases.

From burial No.1, we have got seven short Cylindrical gold beads, having a length of 0.2 –0.3 cm. And diameter 0.1 cm. All of them were well made. This burial was very important because from this, we collected intact shell bangle, burial potteries and a miniature gold fillet shaped ornament placed just below the right arm. It indicates that burial No. 1 belongs to a very rich lady of high class.

After this discovery, Rakhigarhi becomes one of the important mature Harappan sites of this region, because we haven't found burials having beads as a object of offering from any other sites located nearby.

CONCLUSION

A good number of beads of different materials have been collected from the excavation at Rakhigarhi. Besides finish beads and unfinished beads in various stage of manufacture indicates that Rakhigarhi mush have been an important centre of beads manufacturing, not only for the consumption of the local people but also for tading beads to other places. It is very important to point out that most of the raw material were not locally available, so this lapidaries must have been brought them from outside.

At Rakhigarhi, we found a well established bead manufacturing factory having thousand of bead roughouts, waste flakes and cores, tools and implements and beads polishers. All these things were placed on a mud brick floor in a very specific manners. It indicates that bead makers of Rakhigarhi present on example of highly advanced skill and craftsmanship. They are resorted in etching, engraving and inlaying to enhance decorative value of their product. They take keen interest in making beads and experimented with new ideas.

Rakhigarhi has yielded beads of different material types and shapes. They use varieties of agate, amazonite, carnelian, chalcedony, jasper, lapis-lazuli, crystal, sodallite for making beads. Keen sense was

shown in selecting the raw materials among the varieties of precious and semi precious stones. The natural colour of the stone is used in such a manner that it would form a pattern and would give a better impression, (We got about 2,000 carnelian beads roughouts beads from beads factory in different stages of making. But agates stone for making carnelian beads were not locally available, so the lapidaries imports this stone from from Rajputana in Gujarat region. It shows the presence of social and economic organization at Rakhigarhi.

The number of terracotta beads and beads made of semi precious stones were almost same. It shows the social setup of the people. One can easily understand that the terracotta beads were worn by the poorer people, who cann't be able to buy stone beads (necklace or any type of ornaments) which were very expensive due to their unaviailability within the sites or nearby areas. Only rich peoples were able to buy ornaments or any other decorative items made of semi precious stones. All these interpretation indicates some sort of social division within the society of Rakhigarhi.

After studying and analyzing all types of beads. I can say some thing about the economics aspect of the people, in Rakhigarhi. Number of terracotta beads were more in upper phase of Muture Harappan period. It indicates that after the end of well flourished second phase of habitation, the economic condition of the people become weak day by day. They were not able to buy costly things made of semi precious stones. So they replace terracotta beads with that of the stone beads. May be due to decline in trade. Naturally stone beads were used in abundance. In seconds phase of Mature Harappan Period, which was the phase of well constructed 50 m long street, fortification wall and

other important buildings. Antiquities collected from this particular phase was also very impressive. It proves that when economic condition of the people was good they prefer luxurious item such as costly stone beads or deluxe pottery in daily use. In Early Harappan Period, stone beads were rare in Rakhigarhi, what was the exact reason for this is not yet clear.

Now something more about the lapidary work at Rakhigarhi. Huge number of bead roughouts, cores and flakes with all tools and implements proves that in Mature Harappan Period, Rakhigarhi certainly the biggest bead manufacturing centre in Punjab and Haryana region, and it was one of the most important trading centre fro stone beads too. They import raw material from out side and then with the help of skilled craftsmen and developed technologies, they manufacture beautiful beads of various stone. Almost all types of beads were collected from the side , weather they were locally manufactured or imported from outside.

After analyzing beads of Rakhigarhi it is clear that people prefer steatite beads more. We got about 80% beads made of steatite only. They brought these material from near by sources. We collect thousand of finished and unfinished steatite beads from RGR1 and RGR2. It is very interesting that frequency of steatite bead on the site was more in the upper level of Mature Harappan Period after that we notice a sudden change in the popularity of steatite beads, which goes down very rapidly. May be unavailability of the raw steatite was one of the reason. But in present we can’t say anything regarding this.

In total 11421 beads, about eight thousand beads were comes from RGR-2 combined with RGR 4, which were the citadal mound where the

rich people lived. They have enough money to buy precious item. Number of beads also suggest that citadel mound was very densely popular.

One thing is very clear after studying the various type of beads of Rakhigarhi, is that lapidary works was the major crafts here because we haven't found any other important evidence of crafts activity within the settlement and lapidaries work was the most developed, large scale industrial activity of Rakhigarhi.

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RGR-1: CHART SHOWING DIFFERENT MATERIALS OF BEADS FOUND IN DIFFERENT STRATA (97-2000)

Materials:-

Layers	Steatite	Faience	Terracotta	Paste	Shell	Carnelian	Agate	Jasper	Lapis-lazuli	Surpentine	Gold	others
1.	X	X	X	X	X	X	X	X	X			X
2.	X	X	X	X	X	X	X	X	X			X
3.	X	X	X	X	X	X	X	X	X			
4.	X	X	X	X		X	X		X	X		
5.	X	X	X	X	X	X	X	X	X		X	
6.	X	X	X	X	X	X					X	X
7.	X	X	X	X	X			X				
8.	X	X	X		X	X						
9.	X		X									
10	X											
11	X	X										
12												
13												
14												
15												

16	X											
17												
18												

INDEX: OPEL, FELD SPAR, PEARL.

("X" Indicates presence of Beads.)

RGR-2:- CHART SHOWING DIFFERENT MATERIALS OF BEADS FOUND IN DIFFERENT STRATA (97-2000)

Materials:-

Layers	Steatite	Faience	Terracotta	Paste	Shell	Carnelian	Agate
1.	X	X	X	X	X	X	X
2.	X	X	X	X	X	X	X
3.	X	X	X	X	X	X	X
4.	X	X	X	X	X	X	X
5.	X	X	X	X		X	X
6.	X	X	X	X		X	X
7.	X	X	X	X		X	
8.	X	X	X	X			X
9.	X	X	X	X			
10.	X	X	X	X	X	X	X
11.	X	X				X	
12.	X		X				
13.	X		X		X		
14.	X		X	X	X		
15.	X	X			X		
16.	X			X			
17.	X		X				
18.	X		X				

19.	X						
20.	X	X	X			X	
21.	X		X				
22.	X						
23.	X		X				
24.	X		X				
25.	X		X				
26.	X		X				
27.							
28.							
29.	X						
30.	X						
31.	X		X				
32.			X				X
33.							
34.							
35.	X		X				

Cont…

Cont….

Layers	Jasper	Lapis-lazuli	Surpentine	Quartz	Gold	Copper	Others
1.	X	X					X
2.	X		X		X	X	X
3.	X	X	X	X	X	X	X
4.	X	X					X
5.	X	X	X			X	

6.			X				X
7.	X						
8.					X	X	
9.	X	X				X	
10.							
11.			X			X	
12.	X				X		
13.							X
14.			X				
15.							
16.				X			
17.							
18.							
19.				X			
20.							
21.							
22.							
23.							
24.							X
25.							
26.							
27.							
28.							X

29.							
30.							

INDEX: OPEL, FELD SPAR, PEARL.

("X" Indicates presence of Beads.)

RGR-4:- CHART SHOWING DIFFERENT MATERIALS OF BEADS FOUND IN DIFFERENT STRATA (97-2000)

MATERIALS;-

Layers	Steatite	Faience	Terracotta	Paste	Shell	Carnelian	Agate	Jasper	Gold	Copper	Others
1.	X	X	X	X		X	X	X			X
2.	X		X	X	X		X				X
3.	X	X		X				X	X		X
4.	X	X	X	X							X
5.	X	X	X	X		X					
6.	X	X	X							X	
7.	X	X									
8.	X	X	X			X					
9.	X	X	X								
10.	X	X		X							
11.	X										
12.	X		X	X			X				
13.	X		X								
14.	X										
15.	X				X						
16.			X								

17.	X										
18.	X										
19.	X										
20.	X										
21.	X										
22.											
23.	X										
24.	X										
25.	X		X								
26.	X										
27.	X										
28.	X										
29.	X										
30.	X										
31.											

INDEX: OPEL, FELD SPAR, PEARL.

(“X” Indicates presence of Beads.)

RGR-5:- CHART SHOWING DIFFERENT MATERIALS OF BEADS FOUND IN DIFFERENT STRATA (97-2000)

MATERIALS;-

Layers	Steatite	Faience	Terracotta	Paste	Shell	Carnelian	Agate	Jasper	Lapis-lazuli	Surpentine	Gold	Others
1.			X									
2.	X	X	X									
3.	X	X	X					X				
4.	X		X									
5.	X	X										
6.	X		X			X						
7.												
8.	X											
9.												
10.												
11.												
12.												
13.												
14.												
15.												

INDEX: OPEL, FELD SPAR, PEARL.

("X" Indicates presence of Beads.)

RGR-6:- CHART SHOWING DIFFERENT MATERIALS OF BEADS FOUND IN DIFFERENT STRATA (97-2000)

MATERIALS;-

Layers	Steatite	Faience	Terracotta	Paste	Shell	Carnelian	Agate	Jasper	Lapis-lazuli	Surpentine	Gold	Others
1.			X									
2.	X											
3.			X									
4.	X											
5.	X											
6.	X								X			
7.	X		X									X
8.												
9.	X											
10.	X											
11.												
12.												
13.												
14.												
15.												

INDEX: OPEL, FELD SPAR, PEARL.

(“X” Indicates presence of Beads.)

RGR-1; Chart showing Number of beads found in different layer of various Trenches (Session 98-2000)

TRENCHES

Layers	F-5	J-5	K5	K4	L-5	M-5	N-10	N-11	P-11	R-3	W-5	X-5	H-6	J-6	H-5	total
1.	14	7	12	62	6	10			1	10	2	6	6	3	3	148
2.	14	11	13	35	11	8				3		2	13	9	11	132
3.	9	16	11	16	7	16	2	2	1	9	4		6	11	19	129
4.	3	18	1	15	11	15	2	1	5	7	2			5	8	93
5.	2	1		12	6		4	6	8	11				3	3	56
6.		20		3	1			7	9	9				3	1	53
7.					10					3						13
8.					12					5						17
9.					3					8					2	13
10.										3						3
11.										2						2
12.										4						4
13.																
14.																
15.																
Total	**32**	**73**	**27**	**143**	**67**	**49**	**8**	**16**	**24**	**74**	**8**	**8**	**25**	**34**	**47**	**663**

Layers	H-7	K-3	L-4	L-5	L-6	L10	M6	M7	M-10	M-11	M-12	N-5	N-12	J-7	total
1.	1	18	29		16	4	1	26	7	1		1	1	4	109
2.	4	45	32		3	1		10	5	1				5	106
3.	1	25	37		11	4	3	16	6	6	2	1	3	3	117
4.		36	8		6	2	8	23	4			2	3		92
5.		45	17		3		10	3		1			3	5	87
6.		15			4			12		1	9	2	5	9	57

7.		16			9			5			2	3		3	38
8.		13		6	7			10				6			42
9.		1		12								3			16
10.				19											19
11.		4		5											9
12.															
13.		1													1
14.															
15.		1													1
Total	**6**	**220**	**123**	**42**	**59**	**11**	**24**	**105**	**22**	**10**	**13**	**18**	**15**	**29**	**694**

(Note: Pit Materials Not Included)

total No of Beads =663+694=1357

<u>RGR-2 Chart Showing Number of beads found in different layers of various Trenches (Session 98-2000)</u>

L	**M 19**	**Q 18**	**Q 19**	**Q 20**	**R 18**	**R 19**	**R 20**	**S 18**	**S 19**	**S 20**	**U 21**	**U 22**	**Y 24**	**Y 25**	**Y 26**	**Z 23**	**Z 24**	**Z 26**	**Total**
1.	5	9	5	9	5	15	11	6	66	32	20	9	42	8	40	3			285
2.		21	7	24	18	5	10	66	27	9	27	41	7	6	82	2			352
3.	2	16	43	8	18	9	41	126	39	51	6	10	21	31	24		2		447
4.		21	11	15	1		39	83	47	30	1		7	48					303
5.			9	11	2		13	124	10	26		3	1	41				3	243
6.		4	2		3		12	47	25	1			2					3	99
7.			5		10		9	43	9				1	2				22	101
8.			9				6	33	3					5					56
9.			4				2	18	5	1			13	26					69
10							1	23	5				3	8					38

11							5	13											18
12								30											30
13							2	24											26
14							4	17					2						23
15							2	3					2						7
16							5	21											26
17							3	11											14
18							2	8					1						11
19							5	4											9
20							5	4					1						10
21								3					3						6
22								4					8						12
23								3					3						6
24								3					10						13
25													3						3
26													3						3
27																			
28													1						1
29													2						2
30													1						1
31													4						4
32													2						2
33																			
34																			
35													3						3
Total	**7**	**71**	**95**	**67**	**57**	**29**	**180**	**770**	**236**	**150**	**54**	**63**	**146**	**175**	**146**	**5**	**2**	**28**	**2221**

TRENCHES

Cont

L	**B 12**	**B 13**	**B 14**	**B 15**	**C 15**	**C 16**	**G 25**	**G 26**	**H 25**	**U 18**	**V 17**	**V 18**	**T 18**	**W 17**	**W 18**	**Y 17**	**A 16**	**total**
1.	2	90	2	4			1	2	8	16	4	61	6	5	2	1	7	**221**
2.		47	1		1		4	2	5	75	1	139	14	1	12	8	2	**312**
3.		14		1	1	5			7	88		1	21	6	8		4	**160**
4.		1			1	2		1	1	20		7	16	1		16	7	**73**
5.		1				3		1	1			16	42				5	**78**
6.		1					2	14						3				**20**
7.		1				2	3	8						9		1	8	**32**
8.							5	3									2	**10**
9.								1									2	**3**
10.							1	1									2	**4**
11.																		
12.																		
13.																1		**1**
14.											1					3		**4**
15.											2					15		**17**
16.											13							**13**
17.											12							**12**
18.																		
19.											3							**3**
20.											3							**3**
Total	**2**	**153**	**3**	**5**	**3**	**12**	**16**	**33**	**22**	**199**	**39**	**224**	**99**	**25**	**22**	**45**	**39**	**956**

L=Layers,

T=Total. 2221 +956=3177

RGR-4 RGR-5 & RGR-6- Chart Showing Number of beads found in different layers of various Trenches (Session 98-2000)

TRENCHES

	RGR-4						**RGR-5**	**RGR-6**					
Layers	**A3**	**B1**	**C1**	**D1**	**D2**	**XA/2,3**	**U19**	**M5**	**J16**	**M11**	**M12**	**M13**	**Total**
1.	2	4	1	39	9	11	14				1	1	82
2.	2	5	7	2	6	17	18			2		6	65
3.	9	13	2	15	2	14	83			1		3	142
4.			2	21		11	14				1	2	51
5.		2	3	17	2	12	24				2	1	63
6.			1	7		8	12				2	3	33
7.				21		5		2	5		2		35
8.				9			2						11
9.				11							2		13
10.				15							1		16
11.				11									11
12.				5									5
13.				3									3
14.				7									7
15.				11									11
16.				2									2

17.				3									3
18.				3									3
19.				5									5
20.				1									1
21.				5									5
22.				1									1
23.				5									5
24.				3									3
25.				1									1
26.				5									5
27.				5									5
28.				3									3
29.				3									3
Total	**13**	**24**	**16**	**224**	**19**	**78**	**167**	**2**	**5**	**3**	**11**	**16**	**593**

Chapter 12

Shell objects

All the antiquities, which are found in excavation, are best examples of Harappan craft. The most interesting are shell objects. Even though the site is not near any coast, the bangles and other antiquities are surprisingly good pieces of craftsmanship on shell.

Shell objects may seem relatively insignificant compared to other categories of objects in other big sites. But a detailed study of shell working has revealed many important aspects about trade and craft specialization.

A study of Indus region shows that shell working started in that area from about 7^{th} millennium B.C in the Neolithic period. This craft developed more in the further period of Chalcolithic culture. The techniques of manufacture and specific shell species used as raw material have been studied.

Then the period of mid 3^{rd} millennium B.C shows village to urban cities development in the society and this change leads to the emergence of shell workshops at important coastal and inland sites. A wide variety of ornaments and utilitarian objects using several species of marine shell as raw material were manufactured in these workshops. Certain manufacturing techniques and standardization of stylistic features of the shell objects for e.g. ladles, bangles etc. show some kind of connection between the workers staying in the wide spread span of cities. They may also have a network of trade and kin relationship. Through these the trade for raw material was made easy for the distant sites from coastal area to remote villages.

Among the most important species are large gastrodpods such as Turbinella pyrum (Linnaeus), Chicoreus ramousus (Linnaeus), Lambis truncata sebae (Roding) and Fascialaria trapezium (Linnaeus).

In Rakhigarhi also fresh water riverine shells are reported more in numbers. Also the use stated about can be evidenced near fortification wall on RGR-2

The shell workshops at inland centers such as Mohenjodaro and Harappa produced the widest variety of shell objects, while rural centers produced only limited types of objects. It is because the big cities has more trade contacts to the coastal region that the rural area. So even if Rakhigarhi did not yield any kind of evidence for shell working, this does not mean that the objects were not manufactured on the site. But that it was a main centre in trade route which was trading raw material as well as finished products.

Resources

In Rakhigarhi some beads are found made of this oyster type riverine shell having a perforation on the upper side, use for decorating animals. But these were imitated in terracotta. So in all probability shells were used as ornaments just by perforating them. Also fresh water snail shells are found but not in any contextual use.

The marine shell originated from three source areas. The Gulf of kutch and Saurashtra produced several species of shell that were used to make bangles, ladles and inlay. Similar species were obtained from the coast of Karachi and a third source with the Omani Coast. Complete shells as well as partly processed shell objects were trades from the coastal resource areas directly to the large cities.

Typological study

Rakhigarhi excavations have yielded all types of shell objects found in all the other Harappan sites.

Bangle

The style of bangle was also an indicator of different kind of communities living in the cities. From Harappan times the evidence of females wearing bangles is found in figurines. Burials having female skeletons wearing bangles are also reported. Rakhigarhi is also witness to two skeletons of females wearing shell bangles in intact condition. The system of wearing bangles was so that three or four bangles were placed on wrist and two or more on elbow, the number of bangles was same in both the arms.

But the material combination or color combination cannot be identified from the figurines, only the different shapes of bangles are known. The findings from Harappan cemetery substantiate report of bangles being worn on left arm. In Rakhigarhi also the bangles were worn on wrist, two in one burial and one in another. From the study of Harappan cemetery it is proved that the earliest burials around 2600 B.C have shell bangles slightly wider than those found in the later burials, about 2400 B.C and the thinnest bangles are found in the latest burials around 2000 B.C.

It seems that with the passage of time the size of bangles decreased and which means that heavy manual work was not done by these females. The delicate bangles must have been worn as the symbol of high society or elite class.

Also some wide heavy bangles found at different sites show some battering marks on them. That means heavy manual labor was also part of the work of these particular women. These types of wide shell bangles

were never found in any burials. They are also incised with standard Indus chevron (>).

In Rakhigarhi this wide variety of shell bangles has not been found as yet. The shell bangles are thin in section. The incision is also not noticed. But some bangles are unfinished showing that some kind of craft was also practiced at Rakhigarhi. Whatever pieces of bangles are found, they are all good examples of expert craftsmanship.

Ladle

This is the best specimen of elaborate craft. The probable use of this ladle was to pour sacred offering of water, milk, oil, butter etc. in ritual activities. The coastal shell workers cut and ground to prepare a roughly carved ladle and then it was sent to big sites for finishing. Also finished ladles were sent to other places. Usually this ladle is found buried in a room or found near some funerary activity used as offering. At Harappa a large ladle which was found with some pottery was repaired with lead rivet in one of the burials.

There are two more types of ritual objects made out from shell: one is libation vessel made from conch shell Turbinella pyrum. The other type is a trumpet made from same conch shell. It was found at Harappa.

Even after three seasons of excavation, no ladle in intact condition has been found at Rakhigarhi. Only small pieces are found which are sometimes having graffiti. A very good fragment was found in 1998-99 session of excavation, having graffiti on the outer face. Its handle is broken. Also in session 1999-2000 some small fragments of ladle have been found, in this one worked out handle of ladle was found in good condition.

The spoon or ladle made from the murex shell was first created during the Indus period, but its use did not continue after the decline of the Indus cities.

Inlay

These are the small decorative pieces of different shapes and sizes. These pieces are fixed in furniture or wet clay to make different kinds of geometrical or floral designs. The shell pieces were easy to carve and also were combined with wool or clay. They did not fade like bone or ivory, nor did they perish easily. The inlay of shell is also a good example of Indus craft.

Rakhigarhi inlays are of geometrical patterns, such as circular, oval, rectangular, and triangular. Two specimens of triangular type are decorated with vertical lines, which are in only one side. They may have been used in a big design. Some half bangles like curved pieces of inlay are also found.

Beads and Pendants

The beads are found very less in number than the other objects. These are prepared from the central portion of Turbinella pyrum.

The Shapes of beads found in Rakhigarhi are not very peculiar. Thick discular and short cylindrical are main type of beads found. Also elliptical and drum shapes of beads are found. In the session 1998-99 a biconvex rectangular bead was found which was looking like a compass. It had projections of triangular shape from both the sides. It might have been a miniature compass, because the projections were made at perfect angles.

The pendants were also found, made of half curved shape having perforations on both the ends. Some rectangular pendants having perforations were also found but not in full shape. Some small pieces of rings, thin in section were also noticed.

Others

Gaming ball piece is also one antiquity found at Mohenjodaro and Harappa. But it was carved from all sides with concentric circles. It was manufactured from Turbinella pyrum. Some kink of plain ball was found in Rakhigarhi. This is also worked plain and is polished from all the sides. But it is without carving.

CONCLUSION

The coastal shell workers used to export partially finished bangles to big sites and then grinding and polishing was done on these sites. In Rakhigarhi also, basically this kind of work is supposed to have been done by the shell workers. This assumption is based on the fact that, although many kinds of polishers are found on the site, their use is not yet known definitely, as marks or grooves are not noticed. Also the number of shell bangles found is much higher than other shell objects. This implies that the users of these bangles were elite, who kept away from any heavy manual work, thus supposedly belonging to wealthy trading community. As is proved that RGR-2 is a citadel mound having podiums all around, the number of ladles could have been more, but till as yet no sufficient number of ladles could be found. Beads are also not enough in number to substantiate the claim of their import to the site.

The debitage found are not yet studies properly, but the columella found are more of marine gastropods, which proves manufacture of bangles. But no oysters are found, so the fact that bangles were made out only from big shells is confirmed. Considering the fact that they were made according to the required design, one possibility is that, the inlays were also manufactured on site.

The study of shell objects other sites show that shell bangles were used more as ornaments than as objects of daily usage. The high number of bangles found in Rakhigarhi thus in turn proves a higher standard of living amongst these people. It can be argued that, the users were not the common working classes, when we regard the fact, that they could afford shell bangles, which were not manufactured in the region, unlike the cheaper and easily available terracotta bangles. This rather high living standard can be explained by the richness of the agricultural soil, which even today is a source of livelihood for the people of this region.

From the waste material found at Rakhigarhi, so far it is impossible to say, whether it was a large site and a manufacturing centre for shell object. It must have been manufacturing objects for this city itself or neighboring areas. Those centre, which were producing semi-finished and finished products for local and long distance trade, are much larger with high percentage of waste shell material and also some finished goods.

Chapter 13

Bone and Ivory Objects

At Rakhigrahi almost all the tools have been manufactured out of fresh bones of butchered or dead animals. In some cases, cooked material has also been used. The natural long bones of dismembered carcases, fragments of artificially broken bone ribs of large animals, phalanges and antlers, etc have been used as raw material because they were both spongy and resistant. The natural shape of these was most suited for adopting them as tools by using simple techniques like splitting, scraping, notching, retouching and grinding. Bones of freshly killed animal are not required to be softened. In case of an antier a slightly dried out bone is better because it is very resilient in a fresh state.

EVIDENCE AT RAKHIGARHI

RGR-1 : RGR-1 it has been found that the frequency of bone objects in top level from layer (1) to (6) is higher. Suddenly the frequency decreases in lower level. The total number of bone objects found from this mound is one hundred twenty three (123). Out of which only in one hundred ten (110) objects has found from layer number (1) to (6).

RGR-2:- In RGR-2 it has been found that the frequency of bone objects is also very high in top level i.e. (1) to (6) layer. Then it gradually decreases in the lower level. The total number of bone objects found are two hundreds twelve (212). Out of which one hundred seventy nine (179) bone objects are found between layer (1) to (6). In trench S-18 there is very high frequency of bone tools this shows that there was a bone industry in this place. From tranch nu. S-18 only we found seventy (70)

bone objects and two Ivory objects. From layer (1) to (6) there are 6 ivory objects and a horn pieces found.

RGR-4:- In RGR-4 also been the frequency of bone objects is very high in layer (1) to (6), but from layer (6) to lower level very few bone objects in RGR-4 is thirty four (34) of which twenty six (26) bone objects are found in top (6) layer. But in layer number (27) and (28) found four (4) bone objects.

During the excavation conducted by Chandigarh circle at RGR-4 (first session) in 1997-1998, many bone objects were found. Most important of them is a ivory comb one cubical weight and one ivory handle.

RGR-5 :- In RGR-5 only two quadrant has been dig out. In which quadrant U 19/2 as very large number of bone objects and ivory pieces. It shows that there was bone industry in this area. In quadrant V 19/3 only one layer has dig out. In which thirty four (34) bone objects and two (2) ivory pieces has found. The total number of bone objects are one hundred fifty three (153) and from layer (1) only ninety six bone objects are found.

There are eight (8) Ivory Pieces was found. Layer (4) has five Ivory pieces and one Ivory comb fragment also found in RGR-5.

Many other unfinished bone tools and implements are also found. Which shows that there was above industry in this place during Harappan civilization. Polishing stone is also found which was used for making bones sharp and polished. So we can say that there was a bone industry there.

RGR-6: this is a increases in number of tools from upper level to middle and then there is decrease from middle to lower level at RGR-6.

In total twenty two (22) bone objects are found here in none session of excavation (1999-2000).

BONE OBJECTS:-

Most of the bone implements found at Rakhigarhi are made out of ribs of large mammals ox, buffalo (Bos, Buballus etc.). Bone of small animals like goat, sheep and birds were also used. They consist of sharp edged or pointed objects such as the Arrowhead, Awl and needle rather than other types of tools which can be produced easily on account of the fracture of bones stylus. Antimony, rods, engravers and spatula are among other bone tools found at Rakhigarhi. A finely polished spatula pointed at one end and tapering at the other forming almost a long has been recovered. It is rather difficult to distinguish between awls, and needles in many cases as the tip is broken. Generally, those which have at least one point sharp are considered as needles.

Many bone tools varying in length from 4cm. to 12 cm. and having a single or double point were found along with a stone anvil in RGR-1, RGR-2 and RGR-5 from mature phase. This obviously indicates that bone work must have been done in RGR-1 and RGR-5. They were polished and had a round or chiseled butt end after hafting. The section is circular or Plano convex. A notched blade of chert found in association with the awls, suggesting that it was used for polishing them. Sand stone polishers were also found at that place.

Besides shells and chert, engravers of bones were also used in Rakhigarhi. They were either straight or curved and have a sharp point for engraving on steatite and other soft materials. Cutting and sharpening of bone must have been done with the help of knives and razors made of chert, copper and bronze. Flat pieces of bone with sharp edges were used as razors or blades for cutting soft material.

DIFFERENT TYPES OF BONE OBJECTS:-

1. Points: - The points are generally made out of splinters of long bones. They are made by groove-splinter technique. This technique of making bone points goes back to the upper Paleolithic age. In the shafts of long bones, grooves were cut with a burin along with the shaft of the bone. After that, the bone splits into narrow strips along these grooves. One end was thinly scraped with a knife. Finally, the pointed end was further ground on a sharpener and very sharp points were achieved. In order to obtain very sharp points these tools were ground on a fine grained stone plaque. Some times the upper lower surfaces were also used as handles. There are various uses of these points. The available specimens can be divided into the following three types :-

(i) **Oblique Points**:- We found many points of this type in Rakhigarhi. The broader ends of almost all of them are broken, which has made it difficult to state the exact length of the tool. In order to obtain such tools, slicing was used in most of the cases on one side only. Short points with thin and sharp ends might have been used as arrow heads to kill small game.

(ii) **Bifacial Points**:- In this type there are two sub types i.e. a thin sharp points and b. thick points. These points are normally made on shafts of long bones and both the edges are scraped in order to get a point.

(a) **Thin Points**:- There are many specimen of this sub type. There have been prepared from shafts of small animals like goats, sheeps etc. These come under the mature phase with very thin and sharp point. They are 4 cm to 8 cm long 0.3 cm to 0.5 cm thick. It has been ground and polished from

all sides. Grinding marks can be seen on the surface. Such a sharp point has also been reported from Rakhigarhi.

(b) **Thick Points**: - We also have many examples of this sub-type. All of them have been shaped out of shafts of long bones of large animals and have been polished very nicely. The polishing on their surface suggests that they might have been used as bone needles in stitching. Such needles have been reported from other Harappan sites also like Surkotda, Chirand, Tal-i-siah, Madavan.

(iii) **Unpoints**: - There are too many specimens of this type. All of them are very crude and their surface shows encrustations effects. These might have been used as barbs for the fishing spears such types have been reported from Botany Boy.

Above mentioned each type of bone points have found in RGR-1, RGR-2, RGR-4, RGR-5 and RGR-6. Maximum number of bone points have broken with its blunted end few of bone points have broken with its working end very less number of bone point have found intact.

These type of bone point are already reported from other important Harappan sites such as Harapa Mohan-Jo-daro, Surkotada, chanhundaru, Lothal, Kalibanga etc.

2. Engravers :- At Rakhigarhi nearly fifty one (51) intact engravers has been reported from Rakhigarhi (table no.7) and large number, broken engravers are found. They were also shaped out of long bones of small and big animals. In one case a 'Avian tibia' has also been used. The some techniques as which were utilized for preparing points were used for preparing engraver. The only difference between the two is that

points are abrupt and not so sharp. It can be held comfortably between the fingers.

This tool was used for engraving pottery decorating probably and for cutting and engraving soft objects like steatite.

These types of bone engravers is already reported from other important Harappan sites such as Harrapa, Mohanjodaro, Surkotada, chanhundro, Lothal etc.

3. Stylus :- There seem to have been used for engraving and for writing or scratching and incising. Some of them are rough while in general their tip is shaved exactly as is done on the case pencils in present day. They have only on one side. As many as fifty nine (59) pieces of intact stylus fire belong to Rakhigarhi. Many broken pieces have also been reported.

Additional evidence comes in the form of engraving on terracottas which might have been done with the help of bone stylus. Very likely these styluses must have been used for engraving and writing. These styluses have their working edge on side, well polished and most them here circular sections.

These type of stylus are already reported from other important Harappan sites. Such as Harappa, Mohanjodaro, Lothal, Sukotaa, Chanhundaro, kalibanga etc.

Following specimens are illustrated and described :-

(1) Stylus :- It is a complete piece and well preserved working edge on one side, the other edge is blunted. It has thick circular section and polished surface brownish colour. Tip resembles with the pencils of modern time. Length (extant) 9.0 cm max dia 0.9 cm from RGR-5, Layer(3) (Fig 2;1)

(2) This is also a complete piece of moderate size Working edge on one side very pointed, the other edge is blunted. Some cut mark also present circular section nicely polished, Yellowish colour, Length (extant) 6.5 cm maximum diameter 0.6 cm from a RGR-5 Layer (1).

(3) This stylus have sharp tip, intact, circular section, well polished, brownish colour. Length (extant) 8.7 cm. max diameter 0.8 cm from a RGR-5 Layer (1).

4. This is also full and complete piece and is well preserved. Working edge is one side other edge is blunted, well polisher thick circular section. Length 8.6 cm max diameter 1.0 cm from RGR-1, Layer (1).

5. Intact and well preserved edge is very pointed, other one edge is blunted circular section, yellowish colour, polished, length 9.5 cm, max diameter 0.9 cm from RGR-1 Layer (2).

6. Intact and best preserved circular section having a polished surface, brownish colour, length 9.0 cm max diameter 0.6 cm from RGR-1 Layer (6)

7. Intact and well preserved circular section having a polished surface, one edge is very pointed. Well made yellowish colour. Length 10.1 cm. max-dig 0.8 cm. from RGR-2 layer (2).

8. Intact and well preserved Circular section having a polished surface, one edge is very pointed. We made yellowish colour length 10.1 cm max-dig 0.8 cm from RGR-2 Layer (2).

4. Kohal Stick

Thirty one (31) Kohal Sticks of bone have been reported from Rakhigarhi (table no.7) all of them are in fairly good condition. Besides some broke pieces are also found. They have been chipped and rubbed and fashioned to shape and finally smoothened by a polisher, majority of them have working edges on both ends.

Similar objects have been reported from many of the Harappan sites such as Mohanjodaro, harappa, Kalibanga, Surkotada etc. Marshall calls them ‘awls’. Their soft and polished surface indicate that they were used as house hold articles such as application of collyrium rather than for any other ‘rough’ use as ‘awls’. Many of them are made from ivory and bone and they are finely polished.

These type of Kohal sticks are already reported from other important Harappan sites such as Harappa, Mohanjodaro, Lothal, Kalibanga, Surkotda, Chanhudaro etc.

Following specimens are illustrated and described:

1. Very well preserved and round in section with smooth surface having working edges at both edges. This is a fine and complete specimen, redish-brown colour. Length – 7.6 cm mx. Dia 0.7 from RGR-5, layer-1.
2. With round section, both edges having smooth surface one edge is very pointed other one edge slidly blunted well polished, blackish-red colour length 8.8 m max dia 0.7 from RGR-5 layer (4).
3. With circular section, very well polished brainwashed in colour with black spout. Length 8.5 max dia 1.0 cm from RGR-5 layer (4).

4. Very well preserved and intact. Roundish section, blackish brown colour, nicely polished length – 10.8cm max dia 0.9 cm from RGR-5 Layer (5).
5. Intact very well preserved with smooth surface having working edge on both side is round section, brownish colour Length 9.4 cm max dia 0.8 cm from RGR-1 Layer (1).
6. Kohal stick full and intact piece with circular section, polished surface both end were used mark present brownish colour. Length 8.5 cm max, dia 0.8 cm from R.
7. RGR-1, Layer (6).
8. In fact very well preserved with smooth surface, having working edge on both side, circular section, brownish colour both edge were used mark present, length 6.8 max dia 0.9 from RGR-2 Layer (6).

5. Hair Pin:- As many as fourteen hair-pins of bone have been reported from the excavations at Rakhigarhi. Most of them are in very good condition. They have been chipped rubbed and fashioned to make them sharp and were finally smoothed by a polisher.

Specimens of hair-pin comes from RGR-1, RGR-2 and RGR-5, they have a tapering shaft and a large button head above tow sharp ridges. Such hair pins were found at Harappa, Mohanjodaro Lothal also.

These type of Hair Pin's are already reported from important Harappan sites such as Harappa Muhanjodaro, Lothart, Surkotada etc.

Following specimens are illustrated:-

1. Hair Pin: Intact very well made circular section, well polished, yellowish colour, Length-10 cm Max dia 0.5 cm from RGR-1; layer 5.

2. Intact with circular section best preserved, and well polished brownish colour- Length .8 cm max dra 0.9 from RGR-1, layer (7).
3. Intact well preserved circular section, very well made one circular incision decoration is present; used mark also present, yellowish colour, polished Length 9.0 max dia 0.9 cm from RGR-1 layer (15) early Harappan level.
4. Intact well preserved circular section, very well made, both edge blunted very well made, used mark also present. Polished, brownish colour, Length – 11.0 cm from RGR PRG-2 Layer (1).

6. Spatula - Twelve (12) spatula of ivory and bone have been reported from the excavations at Rakhigarhi. Most of them very fine and well polished but broken. They were made out of the shaft of a long bone of goat or sheep. One end has been scraped from both the edges to give a flat round end on the ventral side. On the right side a noteh or guard has been made. This tool was used probably for engraving thick lines on pottery and for rubbing the surface smooth.

7. Needle : Only four needles of bone have been reported form Rakhigarhi. All of them are in good condition. They have been chipped, rubbed and fashioned, to particular shape and finally smoothened by polisher. They have very thin circular section. These were, perhaps, used for sewing cloth.

These type of needle are already from other important Harappan sites such as Harappa, Mohanjodaro, Lothal Kalibanga, Surkatada, Chanhudaro etc.

8. Dice :- Three dices of bone have been reported form Rakhigarhi. They are found both in rectangular and squarish shape. They occur at

all levels and some of them are exceptionally well made, but “in no case have two similarly marked dice of similar shape been found together”. In modern dice, the sum of two opposite side equals seven, which is not true in any of these dice. Generally these are numbered 1 opposite 2 and 3 opposite 4 but there are variations. In size, also they very considerably, ranging from 8 cm to 10 cm in lengths. Most of these show evidence of much handling their edges and sides shows the signs of their long use. In fact, constant handling and age has darkened most of them to a deep brown tint.

i. **Square Dice** :- It is found in RGR-1. It has squarish section and 8,4 cms in length and 0.6 cms in thickness very fine, well polished material is bone. In one such example we have three (3) circles with dot on one side, the other side has two (2) circles with dot on both end, the third side has one circle with a dot on the middle portion and the fourth side has twenty three (23) irregular inside line.

ii. **Square Dice** :-- It is found from RGR-2. It has a squarish section, and measures 9.8 cm in length and 1.2 cm in thickness. Made of bone, it is well made, and well polished. One side of the dice has two double circles with a dot on both end which is done with incision opposite of the above mentioned slide has two parallel straight lines also done with incision. The remaining two sides are blank.

iii. **Square Dice** :- It is found from RGr-1. It has a squarish section and 9.7 cm in length and 1.0 cm in thickness. Made of bone, it is well made and well polished one side of the dice has two single circle with a dot on both end which is done with incision. Opposite of the above mentioned side has two parallel strength lines also done with incision. The remaining two sides are blank.

9. Ballence Stick :- This type of balance stick is found from RGR-2. It is 6.2 cm in length and 0.8 cm in thickness. This balance stick is half broken and is squarish in section. In the middle of balance there is a hole. On the side of these stick another half perforation was existed.

10. Beads :- Thirteen (13) bone beads have been found from RGR-1, RGR-2, RGR-4 and RGR-6. They all are well polished and are of different shapes and sizes. Most important shape of these beads are, barrel, bicone, cylindrical, disc etc. Some of these beads and intact while others are broken. Among them a fine barrel bone bead was found. It's length is 5.2 cm, max. dia. is 0.6 cm. circular perforation was made in both the ends.

These types of bed are already reported from other important Harappan sites such as Harappa, Mohanjodaro, Lothal, Kalibanga etc.

Following specimens are illustrated and described:

a. Bead short cylindrical shape polished and black in colour- Length 0.8 cm, dia 0.3 cm from RGR-1 Layer (1).
b. Barrel shape bead, well polished and brownish in colour,Length 3.8 cm. max. dia. 0.9 cm from RGR-1, Layer (6).
c. Long Barrel shape bead, well polished surface, brownish in colour, circular section with perforation length 5.2 cm; dia 0.6 cm from RGR-2 layer (2).

11. Arrow Head :- Twenty eight (28) intact arrowhead of bone have been reported from the Rakhigarhi. Most of them are in fairly good condition. They had been chipped, rubbed and fashioned to give their shape, and were finally smoothened by polisher. Arrowheads have basically two features one is working edge and another one is long tang

for hafting in wooden stick, in these arrow heads. Most of them have of circular section. Many types of arrow heads have been unearthed in excavation from Rakhigarhi.

These type of arrowhead are already reported from other important Harappan sites such as Harappa, Mohanjodaro, surkotoda, Chamhundro, Lothal, Kalinaga, Banawali etc.

12. Spearhead :- thirty three (33) spearhead of bone have been reported from the excavation at Kakhigarhi. Most of them are in fairly good condition,some of them are in broken as well as blunted end. The working edge of most of the spearheads are well polished and their hafting end is left unpolished and only chiseling was done. Most of the spearheads have circular section, but some of them have triangular and rectangular section also.

These type of spearhead are already reported from other important Harappan sites such as Harappa, Mohanjodaro, Surkotada, banabali, Lothal, Kaliwanga, Chanhundaro etc.

13. Awl :- Only three (3) pieces of intact awl are found from the Rakhigarhi. Rest of all are found broken. A rod with a chisel – edged tip which must have been hafted in a wooden handle were used as an awl. This was well made, well polished having a circular section.

These type of awl are already reported from other important Harappan sites such as Harappa, Mohanjodaro, Surkotada, chanhundaro etc.

14. Amulet (Otolith) :- It appears that the ear bone (Otolith) of sea fish were also used as amulet. Only two specimens have been found

from Rakhigarhi from RGR-2 layer No. 27 which is of mature phase; and another one was discovered from RGR-1 in the layer (1) which also belong to the nature phase.

So from these evidences we can say definitely that the Rakhigarhi people had a contact with the coastal people.

15. Rods :- In Rakhigarhi there are three (3) pieces of bone rods were found in RGR-1 and RGR-2. These rods have circular section. They are found without a disc top. In few instance the thinner end in rounded off and the thicker edge is flat. They are indicated uniformly smooth surface which is well polished.

In RGR-1 a big bone rod is found. The length of this rod is 17 cm. and its diameter was 1.3 cm. They have circular section and their thicker portion had a slightly curvature. They are well polished. Yellowish colour.

These type of rods are already reported from other important Harappan sites such as Lothal Mohanjodaro, harappa, Chairhundaro etc.

DIFFERENT TYPES OF IVORY OBJECTS

1. COMB :-Only two (2) broken ivory combs has been found at Rakhigarhi. One of them is found from RGR-5 which was totally fragmented nature another one is found from RGR-4 and at present this is the custody of Chandigarh circle. This comb has only three broken teethes and all other teethes had been destroyed by the ravages of time. It was decorated on both sides by incised circles consisting to two lines in three rows. The rest of the details are not clear. Similar combs have

been reported from Mohan Jodaro. Harappa Surkotda they are all of the same type thereby emphasizing their cultural homogeneity.

2. Handle :- Only one handle of ivory have been reported from the Rakhigarhi excavation. It is found from RGR-4 during the first session excavation conducted by Chandigarh circle. It identified as a handle of dagger. Handle is well polished and it has a copper screw suggesting that it was a dagger with handle. However, digger is missing only handle is found from excavation. These type of ivory handle are already reported from other important harappa sites such as Harappa, Mohanjodaro Surkotada etc.

3. Square Dice :- This dice made of ivory have been found from RGR-2. It is half part is broken and its length is 5 cm and thickness is 1 cm on the three sides we have one double circles with dot and on the fourth side have two parallel incised straight lines.

These type of ivory dice are already reported from other important Harappan sites such as Mohanjodaro, harappa, Chanhundaro, Surkotada, Lothal, Kalibanga etc.

4. Bead :- Only one discolour bead of ivory has been found. In the excavation at Rakhigarhi. It is pale yellow colour. From RGR-2 layer (5).

5. Spatula :- Only one thin section well polished spatula of ivory found yellowish colour from RGR-2, layer (6).

6. Weight :- a single cubical weight is found from Rakhigarhi. It is well polished and finally made.

7. Bangles :- Two small broken pieces of ivory bangles have been found. One of them have rectangular section and the other have a pentagonal section, with well polished surface.

8. Cut Pieces :- Nine (9) cut pieces of ivory have been found from Rakhigarhi . Mainly they came from RGR-5. The cut marks on them are clearly visible. Probably it must have been cut by some sharp metal tool (saw). These ivory cut pieces might have been reused by the ivory worker in some other ivory items.

Excavation at Rakhigrhi have yielded a number of objects made from bone and ivory. It appears that the ivory industry was a flourishing one mature phase as revealed by the find of and huge elephant tusk cut pieces. These have been prepared after splitting flaking and polishing them. They very careful manner in which they were prepared indicates the mastery of the craftsmen at Rakhigarhi the uniform and proportionate size of the object at Rakhigarhi from the mature phase reveal the homogeneity of the industry of the cultural complex at this site.

Chapter 14

Stone Tools and Implements

At Rakhigarhi data was collected about the tools and implements recovered from both Early Harappa and Mature Harappan levels. In the first season of our excavation we have excavated in mound RGR-1, RGR-2, RGR-4 and one trail trench in RGR-6 under the guidance of out director. But in the second season of our excavation we have extends out work in mound RGR-5 and RGR-7 including the former mounds. Though RGR-7 was the Harappan burial mound. This year we have done large scale excavation in mound RGR-6 and one trail trench in RGR-5. Among these mounds the RGR-6 popularly known as Arda mound is entirely Early Harappan deposit and evidence form RGR-1 and RGR-2 which was hidden under the Mature level. The comments about the subsistence pattern and industrial activities on the basis of tools and implements used by the Harppan peoples are as follows.

For the manufacturing of their tools they have used different tools and implements e.g. anvil, hammer, moulds etc. which known as tool making tool. Almost from all the Harappan sites the hammer, anvil, crucible has been reported. From Lothal we have got the moulds for manufacturing coppers tools like pin. Though no such moulds have been recovered from Rakhigarhi.

Chert blade production was definitely major craft and industry in the Harappan world. Though the production of blades started from the Upper Palaeolithic period but the Indus blades and blade cores popularly known as fluted core can be distinguish from those of the earlier periods

by their greater length and regularity, which is considered to have been achieved by the use of copper punch, possibly set into the ground from removing blades. These blades, flakes and cores have been recovered in abundance nearly from all the Harappan sites. The most interesting evidence is the presence of fluted core and blade in the Early Harappan levels at Rakhigarhi –I (Amarendra Nath: Further Excavation at Rakhigarhi: Puratattava 29: 46- 49). Huge number of chert blades, asymmetrical flakes and few fluted cores from Rakhigarhi clearly indicating that these tools were manufactured here.

Hunting was an important subsistence pattern to the Harappan people which is clearly evident from the hunting tools and implements made by both bone, stone and copper or bronze. The arrow head and spear head made by the same materials are reported from all the Harappan sites, even from Rakhigarhi also which were used as a composite tool, that mean all these tools were hafted by the different material before the use of it.

Fishing also practiced by the Harappan. Evidence of fish hook has been reported from different sites like Mohenjo-dara, Harappa, Chauhu-daro, Lothal even in Rakhigarhi. All the fish-works are very developed in form having projected barb and thin tip for fixing the thread. It was also used as a composite tool. The features of the fish-hooks clearly indicates that these were used for catching big fishes. According to S.R.Rao the Lothal people used it to catch the sea fishes.

Agriculture played a major role for their subsidence right from the beginning of the Early Harappan levels. Which are clearly evident from their agricultural tools and implements. We have already come to know

the discovery of the ploughed field surface at Kalibangan in the Early Harappan levels. Even we have got the terracotta model plough from the banawali and Rakhigarhi of the Harappan period. Stone plough share has also been reported from Mohenjo-daro.

For their domestic work the Harappan people used to use different tools and implements made from different materials like stone. The Most remarkable domestic tools and implements are querns which are of different types like footed quern, saddle quern, flat quern, circular quern and muller, pestle etc. All these tools and implements are reported from each site, though all the shapes are not reported from each site like the footed quern are very rare. The tool typology of the previous chapter can give the exact answer.

The Harappan also showed their skill by constructing their well secured shelter in a rectangular fashion of cardinal direction which is clearly evident at Rakhigarhi. Their building material was moulded brick both mud and well fired. In some sites they have used even stone also. Dholavira is the burning example of this in India. Definitely all the bricks except stone were moulded. Though such type of mould has not been reported till now as far as I know. Probably all these moulds were wooden made so it have been perished very early. But we have got a very important tool which generally use to maintain the perpendicularity of the construction i.e. plumb-bob. Both copper (from Mohenjo-daro) and terracotta plumb-bob from different sites even from Rakhigarhi have been discovered.

Utensils are very important to the people for their domestic activities. These utensils are basically either made of terracotta or

metal. Though the evidence of stone utensils are also there. The Harappans mainly used their utensils made of terracottas. The manufacturing of pottery is a very complex craft which needs a number of tools and implements like wheel, wooden mallet, dabber etc. Generally the wheel is made of wood though the evidence of stone wheel still existed. The dabber is generally made of terracotta. This year (1999-2000) we have got three terracotta dabber from Rakhigarhi. Out of these three evidence one recovered from RGR-4 which was made by the stem of dish-on-stand and the other two was hand made.

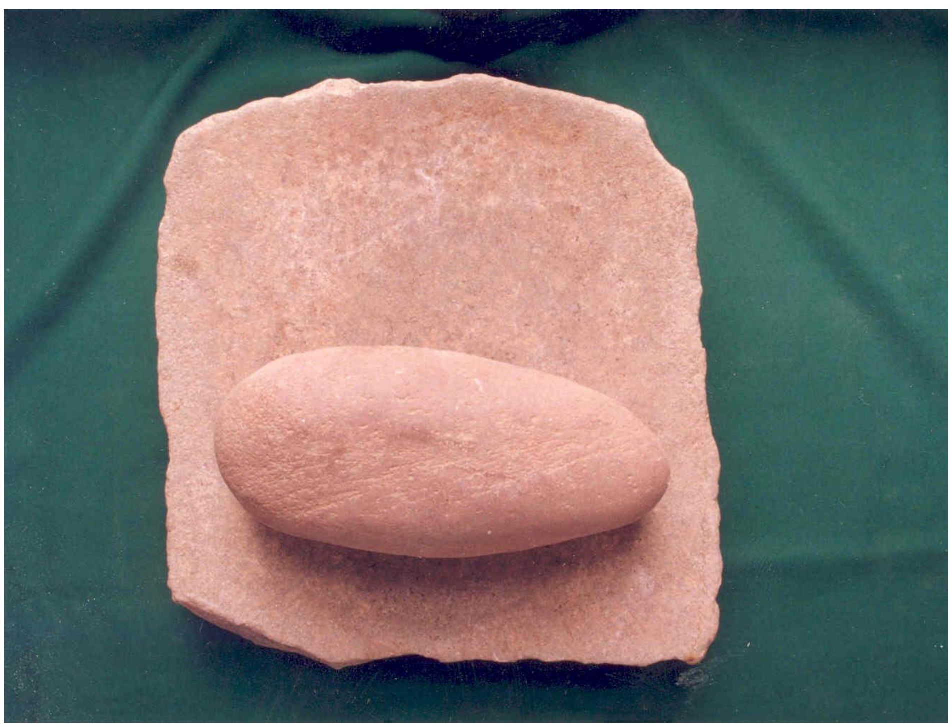
Another specialist craft of the Harappan period was the manufacture of beads i.e lapidary work from semi-precious stones, particularly from carnelian, agate & jasper. The discovery of a number of Harappan carnelian bead factories is obviously a considerable interest. The factory site was fast noticed by Mackay in 1937 when he excavated the site Chauhu-daro. Another two factory was excavated by S.R. Rao at Lothal & Shaffer & Fairservis at Allahdino. With these three sites I can easily include the name of the fourth site i.e Rakhigarhi. During this session excavation (99-2000) the discovery of more than three thousand carnelian and other semi-precious stone bead rough out, debitage & finished beads in the RGR-1 of trench no J6 just on the slope of the highest point of the mound proved the lapidary activities. Besides these we have got there a small kiln, polisher, quern, anvil & few drill bits. The kiln was used to heat the rough out for making perforation easily and gaining the desired colour, some rough touts were also inside the kiln.

Copper smelting and melting of metal was also practiced by the Harappans. The copper furnaces recovered from different sites like Mohenjo-daro, Harappa, Lothal, Kuntasi are the remarkable examples of primary manufacturing activity. Though till now no copper furnace have been discovered from Rakhigarhi. I hope in future the further

excavations will fill up this blank. A number of crucibles made of terracotta have been discovered from this site. So definitely the secondary manufacture of copper objects was practiced by the Rakhigarhi Harappan people.

A number of copper and bronze chisel both big and small in size have been discovered from many Harappan sites including the Rakhigarhi. So the minute carving of bone and ivory, carpentry, leather craft and any other artistic activity was took place by the Harappans.

So from the above mentioned points with proper evidence it is clear that the Harappan subsistence pattern was very complex and I can conclude that definitely there was the class system and specialization of work in the Harappan world.



Pl1. Stone Implements, mature Harappan period

Appendix 1

Explorations around Rakhigarhi

The Harappan site of Rakhigarhi was subjected to locational analysis to asses its potentialities as the regional centre. The excavations and explorations around Rakhigarhi (1997-2000) put extent of the site around 124 hectares, and if the land between different mounds is taken into account it exceeds beyond 240 hectors. Hence, it becomes not only largest site in India; but also the most extensive site of the Harappan domain. This phenomenon has led to further locational analysis of the site.

1] **Gamara**

Location:- The Ancient mound close to the village Gamara is also known as " Danala kheda Para" locally. This mound is located approx. 600 m. away from the RGR-6. This mound is approachable by the cart roads going towards Lohari Ragho.

The Mound: - This mound is roughly oval in Shape, spread 495 m. from north to south and 371 m. from west to east. The thickness of the habitation deposit is 1.5 m. The central part of the mound is well preserved, in peripheral areas from all directions it is cut down by the agricultural canals. Some of these canals especially eastern canal is quite helpful as clear stratification could be seen here. The topmost layer is 27 cms thick, yellowish brown in colour, consists of sandy loam with coarse grains. This layer is also disturbed by vegetation present on surface. Second layer is 55 cms. Thick greyish brown in colour, consist of sandy –clay with fine grains. The third layer is approx.30 cms, dark brown in colour, consisting sand-clay and kankar.This layer is quite compact in

nature as compaired to the previous layers. Occasional pits are also seen between second and third layer. Most of these pits are blakish grey in colour. Some patches of ash are also noticed. Good amount of potsherds are present in these sections as well on surface of the mound. Potsherds and other artefacts were collected from surface by random sampling.

Ceramic Assemblage:-Pottery collected from the surface of this mound has revealed the existence of early Harappan, Mature Harappan, Late Harappan and Ranga Mahal cultures.

a) Early Harappan Pottery:-Very few sherds of this period are found. It is represented by the existence of buffed ware, chocolate slipped ware, grooved and incised pottery. Among the buff ware, only diagnostic shape is globular pot with slightly everted and external rounded rim. A thick band on neck as well thin horizontal bands with a single wary line at the bottom is painted in block colour.Few sherds of grooved variety have horizontal grooves on red-buff surface. There are few sherds of wavy incision incorporated among horizontal straight grooves. All the above wares are essentially well-levigated, well fired and fast wheel pottery. Though chocolate slipped ware is well fired or made with fine clay; it seems to have been made on slow wheel.

b] Mature Harappan pottery:- Sherds of this period are represented by black on red ware. The main shapes present here are of large storage jar, dish on stand, basin, dish bowl, and goblet. Sherds of storage jar are quite thick in section with short quadrangular rim. The sherds are well fired; are given thick slip of red colour. Horizontal bands and wavy lines are applied in black colour.Base of goblet, few shreds of globular pot and bowl are noticed. Some bowls have beaked rim profile bent sharply to exterior, making an accurate angle to body.

c] Late Harappan Pottery:- Here most of the shapes and motifs of mature Harappan continued ; but quality of the fabric is degenerated. For example, a sherd of dish represents the typical nature shape of dish; but doesn't given the same metallic sound, it is not very well fired. A dull small globular pot, handles, having outurned bedded rim red orange slip is applied. Other shapes present here are thick and medium sherds of storage jar with short beaked rim, here beak is oriented about 45% from horizontal having rounded internal edge. Among the painted motifs coloured in black horizontal bands and jalli or net pattern are seen.

d] Kushana Pottery:-The fourth assemblage which could be differentiated here is of early historical period. This pottery is basically wheel made, reddish or pinkish and yellowish in colour. Coarse red ware is dominant ware. The main shapes present here are again medium and small storage jars, globular pots, dish, bowl and lid. Some fluted sherds of globular pot are also seen. Decorations are made with incisions having diamond patterns, wary line and with paintings having horizontal bands and jallies.

Antiquities :-

Among the terracotta subjects a single intact specimen of triangular cake which is self slipped and again a rounded cake with tapering ends are found, it bears depression created with thumb on top only. A solid toy cartwheel made in terracottas is also reported. This is plain on one side and has got a projection on the other side with perforation in the centre few fragments of terracotta bangles are also found with circular and square section. A small copper rod (4.5 cm) is also reported. A fragment of fiancée bangle is also found. It is elliptical in section. Three fragments of rubbing stones are also found one of them is rectangular in shape and

made in pinkish red quartzite. Other two are found in shape made of rhiolite.

2] Budana:-

Location:- The relics of ancient mound are found a half km. towards the north of village Budana. This mound is almost 4 Km. Away to the south of Rakhigarhi. This mound is quite close to Narnaund-Rakhigarh, metallic road; approachable with a kaccha road through fields by ten minutes walk.

Mound:- The entire mound of Budana is reduced down and converted into agricultural fields. Therefore, it is not possible to determine the exact size and shape of the mound. Only around 70-80 cm. accumulation of debries is left out. Approximately this mound is 105 m long and 70 m. wide. Potsherds are found mainly from canal dug for agriculture and from surface of the fields. Due to standing crop it was quite difficult to do proper sampling. No sections present along canal walls showed evidence for stratigraphy.

Ceramic Assemblage:- reveals two cultural phases.
A) Mature Harappan and
B) Kushana.

A) This period is represented by few sherds of storage jar, and bowls, further identification of shapes is not possible as shreds are quite small in size. But these sherds are well fired; made of well-levigated clay. Thin slip is applied ; black horizontal bands are also seen on red surface.

B) Assemblage here is of Kushana coarse red ware. Predominant shape is knife edged bowl with pointed simple rim having narrow base and

wide-open mouths. Dish, Globular pot, small pots, lamps are the other shapes. A single fragment of grey ware is found.

Antiquities :- Only a single rounded terracotta *mustika*, which bears a finger impressions and few terracotta bangles with round section are found.

2] Haibatpur:-

Location:- Ancient mound located close to village Haibatpur is situated five km. away from the northwest of Rakhigarhi. This habitation mound is present right on the northeastern periphery of the village, close to water-supply office. This is approachable by metal road.

Mound:- The entire mound is destroyed by agricultural fields, modern irrigation canal, lake, as well construction activity of the water supply office. This mound is circular in shape, spread 260m from north to south and 240 east to west. Thickness of this habitation deposit is almost reduced to ground ; which is raised not more than 60-70 cms, above the ground level. Most of the Sherds are found behind supply office fields and canals dug through fields.

Ceramic Assemblage:- Shows the following cultural sequence -11 early Harappan and 21 Mature Harappan i.e.:-

i) Very few sherds belonging to early Harappan level are found. Due to the fragmentary nature and small size shape could not be identified. These sherds are th8in in section; to and well fired. Main wares reported here are buff ware, chocolate slipped and dull red ware.

ii) Mature Harappan sherds here are represented by typical red slipped sherds; fluted shreds, fragments of perforated jar and thick sherds of storage jar are the main shapes indicating the presence of mature phase here.

iii) Third Phase seems to have been occupied by historic people. This is again indicated by red ware. But this differs in surface treatment, historic pottery has given pinkish red slip. Another veriety is yellowish red pottery. Rimless bowl with wide-open mouth, lamps, matkas, globular pot are main shapes present here.

Antiquities :- Few fragments of terracotta bangle are found. A small tubular or cylindrical stone striker with slightly rounded ends is another artefact made of yellow sandstone.

3] Milkapur:-

Location:- An ancient mound was located to the north of village Milkapur close to the eastern side. This village is situated six k.m. away from the east of Rakhigharhi. Axis to site is again by a Kaccha road which passes through fields by the side of lake.

Mound:- This mound of Milkapur is completely encroached by agriculture. But fortunately not levelled to the ground; as still it is raised 1.5 m. high from the ground level. A house is built on top of the mound itself. This mound is spread 277 m long e-w and 162 m wide N-South. The central part of the mound is cut into perfect rectangular block by the channels dug ground. Most of the potsherds are found in these water channels and from uncultivated surface.

Antiquities:- A hopscotch made on potsherd, a small handmade Terracotta top, hemispherical object having flat bottom and piercing on surface, which looks like modern agarbatti stand made in terracotta is also reported. A single circular terracotta cake that has depression created by thumb impression on both sides; this cake has tapering edges. Few 3terracotta bangle fragments, which have circular section, are also reported. Two circular rubbing stones and Polisher made of rhyiolite are found.

Ceramic Assemblage:- of 1.Mature Harappan 2. Kushana and 3. medieval period is revealed.

1] Very few sherds of Harappan red ware are present. Shapes identified here are storage jar, bowls, dish on stand.

2] Kushana pottery is represented by rusticated grooved ware and flooted sherds. This pottery is particularly coarse red ware with yellow or pink colour.

3] Medieval pottery is dominant here. This is again red ware having bowls, flask with perpendicular handle, small pots with-out turning beaked rim. This rim is decorated with oblique incised lines. The deep oblique lines are criss-crossed by shallow oblique lines.

Antiquities:- Three hopscoth of various sizes of terracotta are found. A polisher made of quartzite (river in rarity), which is semi–circular and flat in shape, one rubbing stone made in quartzite (hilly variety of pebble); and another made on sandstone are also found.

5] Kheri Lochab and Kheri Jalab:-

Location:- Twin habitation mounds are located between twin villages- Kheri Lochab and Kheri Jalab. These Villages are 75 Kms.away from Rakhigarhi towards northwest. These villages are accessible by Koth-Hansi Road that is connected to Hansi - Bharwala road.

Mound:- These mounds originally appears to be part of one mound , but at present separated by nine lakes, locally known as "Letada Talab" as well the metal road passing by. The dimensions of mound can be stated as it is completely reduced to the ground. The torn mound is partially occupied by modern village.

Mound towards the lake is completely enchroached by agriculture, this mound is approximately 110 m (E-W) x 90 m (N-S) eastern mound is 75 (N-S) x 30 (E-W) m in it dimensions. Whitish brown soil and occurance of potsherds are the sole criterieas to locate the ancient habitations.

Ceramic Assemblage:-

Kheri Jalab :- Very fragmentary sherds belonging to early and mature Harappan period are recovered. Due to small size, shapes could not be identified. But present buff ware, grooved and rusticated pottery marks Early Harappan level. Thick sherds with bright red slip possibly of storage jar and sherds of fluted indicates the presence of mature Harappan. All the shreds are made of well levigated clay and quite well fired. Few of them have horizontal bands in black colour.

Antiquities:- Fragment of annular bend, few terracotta bangles with rounded section and sling balls of various sizes made in stone and

terracotta are found – terracotta barrel shaped bead terracotta hopscotch.

Kheri - Lochab:-Here sherds are found in good quantity. Here, dominant ware is coa rse red ware, belonging to early historical phase. This pottery is also well fired, given pinkish – red surface. Moreover, it appears post – Kushana pottery. Main shapes present here are globular pots with outrunning rim, storage jar, mataka, and basins, with internal projecting rim and bowls.A broken arricanut shaped terracotta bead and few fragments of quern are found made in sandstone.

6] Lohari Ragho – 1.

Location:- Three mounds are located close to village Lohari Ragho.Distance between mound- I and mound -2 is 950 m approx. and again 1.5 km between mound-2 and 3. Thus these are taken as three separate mounds.

Lohari Ragho –1 is located very close to Lahiri – Haibatpur road on its eastern side, close to kiln. This mound is 6.5 km away from Rakhigharhi to the South West. It is approachable by bullock cart-road going by brick kiln.

Mound:- This mound is completely encroached by agriculture except its top portion. This central portion is also levelled by tractor; still it remains as a raised block from ground level. This mound is also separable due to its whitish – grey soil – potsherds are seen in large quantity all over on the surface of the mound. Brick- bats and stone objects are also seen. The mound is spread 254m E-W and 177 N-S. The thickness of habitation deposit is almost 1.5 m.

Ceramic Assemblage:-

I) Very few sherds of Early Harappan period are found and are confined to fields on the eastern side, thin sherds of grooved and incised pottery represents this phase extisted.

II) Mature Harappan sherds are found in eastern, northern, southern and in central parts of the mound. Thick slipped red ware is dominant; among this dish, dish on stand, goblet, small globular pot, shallow basins and storage jar are main shapes. Few shreds of grooved, instead and fluted varieties are also found. Incisions are made of horizontal bands. Few sherds with painted horizontal bands in block. Among the rims of storage jar beaded outrunning and harrow external projecting ones are seen among the rims. Few sherds of grey variety are also found. Dishes narrow bilateral projecting and slightly internally inclined types are seen. Most of the dishes are with flat base. Goblet of pointed verity, is also present.

III) Historical Pottery:- Here again pinkish red ware is dominant, this is coarse pottery consists of matakas, storage and spouted jars, lid are main types. The rim of some bowls are decorated with two horizontal bands painted in black and in between these bands oblique or tilted incised lines are put with nail.

Antiquities:- A sherd of dull red slipped ware is found with graffiti mark which could be described either as arrow head or boat type. Few fragments of circular terracotta cake are found; most of them are broken. A fragment of terracotta toycart frame is found. Good numbers of terracotta bangle fragments are reported very few of them have

rectangular section and more number of bangle fragments found in section.

Stone objects found here needs special attention.Two large rough pink quartzite garlic are found. A round stone, which could be have been used as weight is made of guirtzite with fine grains. A broken muller of limestone is also found. A round object belonging to corandam family is reported. A cylindrical object with rounded edge is properly cut into section and polished is found.

7] Lohari Ragho - 2

Location:- This mound is located towards south of Lohari Ragho-1, approx. 950 m. away. This mound is approachable by kachha road from Lohari village as well Gamada Village. This mound is close to Dhanala kheda mound of Gamada.

Mound :- The central part this mound is covered by natural vegetation and trees. The surrounding mound is levelled down by agriculture.The thickness of habitation deposit is not more than one m. This mound is spread 276 m. N-S and 218 m. E-W. The surface of this area is full of potsherds scattered all over.

Ceramic Assemblage:- The Sherds found here can be assigned to A] Mature Harappan and B] Historical period.

A] **Mature Harappan:-** Again dominantly represented by red ware occasionally with paintings in black. The main shapes present here are thick sherds of storage jar with short out- turning beaked rim , globular pots medium size pots with out turning rim, perforated jar, pointed based goblets and small pots. A shaft of dish on stand is also reported.

Some Sherds also have grooves and navy incisions. The painting motifs include vertical and horizontal bands as well jalli or crepe-cross pattern.

B] **Historical Period:-** is again represented by coarse. Pinkish red pottery. The main shapes present here are small pots, shallow bowls and small bowls and pots. Few samples of handle are also noticed.

Antiquities:-

Three terracotta cakes of circular shape which are flat in section are found. Two hopscotches made on thick potsherds are also reported. Two sling balls of stone are also found. A cylindrical longish wheat stone made in sandstone, and lot of debitage of unfinished stone objects are recovered.They are made in sandstone, granite, quartzite and Rhiolite.

Another notable feature here is many brick-bats of burnt brick as well some complete burnt brick are seen on the surface of the mound. The size of this brick is 30 x 15 x 8 cm; hence ratio of size is 1:2:3 which indicates the presence of mature Harappan phase.

8] Lohari Ragho – 3

Location :- This is the closest mound to village Lohari Ragho; only 1.5 Km. away from this village, towards the eastern side. This mound is 1.5 km. away. This mound is quite close to Lohari -Haibatpur road and approachable by the same road.

The Mound:- This mound is also completely encroached by mustard crop except the central part. The mound is 402 m. N-S and 277m. eastwest the thickness of habitation mounds is 2.5 m. Good amount of potsherds, brick fragments and stone debitage is visible on the surface.

Ceramic Assemblage: Indicates the presence of

A] Early Harappan.

B] Mature Harappan, and

C] Historical Phase

A] The existence of this period is marked by the presence of dull red wave, rusticated, grooved and incised sherds. Sherds of chocolate slipped ware are also present ;these sherds are essentially made on slow wheel. Storage jar and globular pots are only diagnostic shapes.

B] **Mature Harappan Pottery:-** It is basically red ware with thick slip, in some cases painted in black colour form of horizontal bands. Sherds of storage jar occur with cord – impressions, storage jars also have different rims lime angular beaked rim which is perpendicular to body, externally projecting, short rounded out – turning or beaded rims. Other main shapes are perforated jars, shallow and small bowls, goblet, and fluted pots. Most of the sherds of this variety are made of well-levigated clay, well fired and it is essentially fast wheel pottery.

C**] Historical phase** here is indicated by the presence of few thick chocolate slipped sherds appliqué variety are also found of coarse red pottery with pinkish red slip. A particular feature here should be noted that of decoration of rims by oblique incised lines or" nail impression". This feature occurs on thick storage jar as well thin vessel, small matakas, handies, lids and handles are main verities in shape.

Antiquities:- Two circular terracotta cakes with tapering ends with thumb impression on one side are found. Well-made terracotta hopscotch is also recovered. The other variety of terracotta object is bangle fragments with squarish as well round sections. A striker which is used to retouch the long blades. A rubbing stone, round in shape

made in sandstone, and lot of debitage of red sandstone is also reported and few samples of quartz.

9] Kinnar:-

Location:- An ancient mound is located towards the north of Rakhigarhi; close to village kinnar. This mound is almost 9.5 km. away from Rakhigarhi and 2.5 km away from kinnar. This mound is approachable with cart road from kinnar to Kaparo. The mound itself is cut by this road. The closest identification of this mound is panchayati dharamshala and a medieval well.

The Mound:- This mound is quite intact in the central part. There is no vegetation or disturbance of any kind. Otherwise road is cut by two kaccha roads, eastern portion is quite damaged due to agricultural activity. This mound is 426 m. long E-W and 195 m. wide from north to south. The thickness of the habitation deposit is 1.5 m. The surface of the mound is full of potsherds and brickbats of burnt bricks.

Ceramic Assemblage:- reveals three phases of cultural occupation.

I] Mature Harappan:- is indicated by the presence of sturdy red ware. It includes storage jars with slightly curved rounded out turning rim, small and medium sized bowls, turf, basins and vesses. Few sherds of typical flat-based dish are also found. Many painted sherds are collected Main motif among these are horizontal bands, jalli or crisp-cross pattern, acacia leaves, filled loop with jalli which is quite similar to Kalibanga. Palm shape is also common. Few sherds of grey ware are also reported which are quite reasonable to the shreds from mature level of PGR.

II] **Historical Pottery:-**

This is again indicated with thick red slip. But it pinkish red also have some different decoration treatment to rim which is not common in Harappan period. Either rim is decorated with incised nail marks or it is given wary appearance at the bottom portion of everted tapered rim. Medium sized globular pots, basins, bowls, lid, spouts are seen.

Antiquities:-

Bangle fragments of circular shape, a small well made hopscotch and potters dabber are the terracotta objects found on surface. Among the stone objects sling balls, polisher and lots of debitage of granite are found. One more fragment of a well-made polisher made in sandstone is recovered.

10] Mirchpur:-

Location:- The ancient mound close to Mirchpur is situated 9 k.m. away and to the north east of Rakhigarhi. The mound is approx. 600 m. away from village across Jind-Bharwala road. A cart road going from metal road towards kheri. Jajwan passes by the side of this mound.

The Mound:- This mound is surrounded by the fields. But the main part of mound is not occupied by agriculture yet. Still great amount of destruction is taking place due to villagers. The mound is cut in the central part; a deep trench has been dug to occupy a traillor of tractor. Soil from surface of the mound is brought to the traillor put into deep trench with the help of tractor. Thus this mound is being destroyed by the tractors almost 10 to 15 cm. per hour. Thus with the same rate the

entire mound could be destroyed within a week or two. There won't be any evidence left for coming generations and archaeologist.

It was possible to observe stratigraphy into the deep trench dug out by tractor. This cutting reveals five layers, differentiated on the basis of colour and texture. First layer is yellowish brown in colour, mostly sandy loam with coarse texture. Second layer is dark yellowish brown in colour, again this is sandy loam; but with fine texture. Third layer is dark- blakish grey ash, it is quite smooth and compact also thin in section. Fourth layer is greyish brown in colour and quite compact in nature. Fifth layer is mostly sand, dark brown in colour, it is quite compact and smooth in texture. This mound is spread 240 m. N-S and 250 M. E-W. The thickness of habitation deposit is four m. almost circular in shape.

Ceramic Assemblage:-

The analysis of the sherds collected from the surface reveals the existence of four different periods:-

I] Mature Harappan
II] Late Harappan
III] Kushana
IV] Post Kushana.

I] Mature Harappan:-Is represented by few fragmentary sherds of red ware.

II] Late Harappan:- Period is again distingushed by red slipped pottery ,few shreds painted in black colour. The main shapes present here are small and medium sized globular pots, with out turning simple dish on

stand rim, shallow, bowls etc. Paintings are mostly horizontal black bands, few floral motifs are also seen, with crisp – gross inside.

III] Kushana: – again this phase is represented by very few sherds thick slip of pinkish red ware. Some of these sherds are increased with flower motif. Knife edged bowls.

IV] Post Kushana:- This period is represented by coarse pottery of yellowish slip with increased decoration of nail impression on rim.

Antiquities:- One arriccanut shaped terracotta bead with horizontal bands of incisions is found. Other are stone objects like mullers of sandstone and a polisher of quartile of pink colour as well a rubbing stone of pebble is found.

11] Nara:-

Location:- A shallow deposit is located close to village Nara towards Kharampur Gandas inside the standing fields, 9.5 km. away from Rakhigarhi.

The Mound:- The Mound is completely reduced to ground level by agriculture; at present deposit is few cm.(approx. 40 cm) thick. The existence of ancient mound is only indicated by the presence of potsherds in fields. The exact size of mound could not be determined. But the shreds are found in approx. 100 sq. m. area.

Ceramic Assemblage :- Potsherds collected from surface of this mound reveals two phases of occupation.

I / Late Harappan

II / Medieval

I / This phase is represented by plain red ware. The main shapes present here are storage jar, medium globular pots with wide-open mouth and crinated bowls.

II / This period is represented by course variety of pinkish red ware and yellowish red pottery. Knife edged bowls, shallow bowls, few shreds of rusticated ware and appliqué verity are also noticed. Small pots with high neck and out turning rim.

Antiquities :-

A hopscotch made on pot sherd is found. Other antiquities are of stone, polisher and querns made in sandstone and quartzite.

12] Rajthal :-

Location :- The ancient mound of Rajathal is almost 11 km. away from Rakhigarhi and to the south east of the same. The mound is 2.5 km away from village and visible from Jind- Hansi metal road. It is approachable by a kaccha road.

The Mound :- This mound also shares the same story as Mirchpur. It is being cut down at tremendous rate by tractor. This mound is spread almost 540 m. eastwest and 320 m. northsouth. At present mound is approx. 3 m. high from surrounding ground level; and it must have been more than thus in the past. This mound is not cut of vertically like Mirchpur, so it was not possible to observe the stratigraphy here. Soil is

taken away from all over surface of the mound, no trenches or vertical cuttings are done.

Again most of the part in periphery is brought under cultivation, except few exposed patches on top. The most important noticeable factor here is strong action of alluvial as well aeolian sand with habitation deposit.

Ceramic Assemblage: - From this mound reveals the following cultural sequence :-

I / OCP

II / Kushana and

III / Medieval

I / Occurrence of shreds of ochre coloured pottery indicates the existence of this culture at lowest level as these sherds are found either in trenches or in periphery area. Surface of this pottery ochre coloured, which is extremely rolled and could be easily rubbed out. Jars with out turning and flared rim, vase with loop handle, lid and convey side bowl, ring footed bowls are the main shapes present here.

II / Existence of Kushana deposit is revealed by sherds of red. Polished ware and knife edged bowls of course red ware.

III / Medieval pottery of course red ware and handmade wary rims with pinches is seen.

Antiquities: - A potter's dabber is the only terracotta antiquity found here. Other antiquities are made in stone, mostly in zattcite . Polisher or fragments of quern. A rubbing stone rhiolite and a fragment of an object made in quartz are also found.

13] Panhari :-

Location :- The ancient mound of Panhari is situated 11.5 km away to the north west of Rakhigarhi. It is quite close to Jind – Bharawara road, apron 300 m. away towards the east of this metal road. Panhari village is 1.5 km ahead of this mound towards the north.

The Mound :- This mound is quite high; as it rises almost 7 m. above the ground level. It is spread 750 m. from north to south and 418 m. east to west. Fortunately this mound is entirely intact, though it is being used for agricultural purpose just chana and saraso has been grown.So the destruction is limited to upper few centimetres. No trenches or canals are being dug on mound ; hence it is not possible to slate anything about stratigraphy of the habitation mound. The colour of the soil of mound is yellowish white, which quite differs from the surrounding light brown soil.

Ceramic Assemblage :- Collected from the surface of this mound indicates the presence of

- I} Late Harappan.
- II} OCP
- III} Kushana

I / **Late Harappan** :- Sherds are of red ware and some of them are painted in black. The main motifs are black horizontal bands with wary lines in between them. The main shapes present here are small globular pots with out turning flared rim, shallow and medium sized basins with external projecting triangular, rim, small bowls etc.

II / **OCP** :- Very few sherds of ochre coloured pottery are reported have, small reses and bowls are the shapes present of this culture.

III / **Kushana** :- Polished red ware dominates here in the volume of ceramic assemblage, storage jars, carinated bowls, small dish with incised design made by nail impression on rim, lid, basins with returning triangular rim are the main shapes present here.

Antiquities :- Sling balls made of quartzite stone are found in large number on surface of this mound. A fragment / debitage of finance, and a fragment of ivory bangle is also found. A fragment of polisher made in spotted red sandstone is also recovered.

14] Baganwala :-

Location :- Thin ancient mound is situated to south – east of Rakhigarhi. The distance between these two mounds is 13 km. It is quite close Kagasar – Rajathal road and western – Yamuna canal.

The Mound :- The whole mound seems to have been buried under semi-stabilised sand dunes. As the whole surface is covered with aeoline sand and no potsherds are found on surface. But this mound has been cut at many places either for agricultural or other purposes. It is possible observe stratigraphy at some places. The buried habitation deposit is almost 1.5 to 2 mtrs. Deep at some places. But stratigraphy of habitation deposite itself is not clear. The habitation deposit seems to have been 2 to 2.5 m. thick and the whole mound rises aprox. 5 to 6 m. high above the ground level. Through the extent of the sand dune is 580 m. east to west and 330 m. North-South, This could not be the actual size of the habitation mound. As it is buried under sands it is not possible to determine the actual size of the habitation mound. The potsherds or antiquities found here are collected either from sections, cuts or trenches dug by villagers for the exploitation of soil.

Ceramic Assemblage :- The potsherds on surface of this mound indicate the existence of following cultures.

I / OCP
II / Early Historic.

I / Very few sherds of ochre coloured pottery are found here. The surface of this sherds is orange –yellow, after rubbing it sticks to the hands. These sherds are quite fragmentary in nature; so the shape cannot be defined.

II / **Early Historic Period** :-This includes red polished ware of Kushana period. The main shapes present in Kushana pottery are shallow bowls, medium globular pots. Sherds of Post – Kushana period includes course dull red ware, which includes bowls lid, and sherds of storage jar.

Antiquities :- All the antiquities recovered from Baganwala are of stone. Polisher and a leg (Possibly of Quern) of smooth grained sandstone, and an unidentified object made in quartzite is also reported.

15] Kaparo :-

Location :- An ancient mound is situated on the northern periphery of the village Kaparo that is 13.5 km to the north of Rakhigarhi.

The Mound :- It is totally destroyed by the extension of village boundaries. The main factor responsible for the destruction is an artificial lake, which is known as bada dat.

Though it is not possible to climate the correct dimensions of the mound, on the basis of colour of the soil – whitish brown the eastwest and north south expression of the mound is estimated 650 m. and 170 M respectively. Though it rises - almost up to 7 m. standing structures made in burnt Lakhori bricks are seen – very few potsherds are recovered from this mound.

Ceramic Assemblage :- From Kaparo shows that antiquity of this place does not go back more than Kushana period.

I / **Kushana :-** Deposit is indicated by the presence of polished red ware of pinkish red colour. Sherds are quite fragmentary in nature so it is not possible to define the shape.

II / **Medieval :-** Deposit is seen in form of structures of Lakhori bricks and sherds of course yellowish red ware small bowls, small pots of narrow mouth or opening, lamps.

16] Sotha :-

Location :- An ancient deposit is located between Kaparo and Panhari on Kaparo - Banabhauri road. It is 14 Km to the north of Rakhigarhi.

The Mound :- This mound is completely brought under cultivation of wheat but still no levelling has been done as the shape of mound is not yet disturbed. It was quite difficult to collect sherds and other material due the standing crop. The Mound is 260 m. north – south and 230 M. east –west , The thickness of the habitation deposit is 2.5 m.

Ceramic Assemblage :- details are not known but existence of -

I / Mature Harappan and

II / Kushana deposit was conformed.

17] Kheri - Jajwan :-

Location :- An ancient mound was located on outskirts of village Kheri - Jajwan which 14 km. away to the North – East of Rakhigarhi. This mound is approachable by a kaccha road, which passes between the lake of a medieval well.

The Mound :- As this mound is away from present village it is quite intact and undisturbed. But it is subjected to thick growth of vegetation and trees potsherds are seen in the raingullies. After little scrapping on surface with knife mud bricks are seen at some places , the size of this bricks is x x cm which indicates the existence of Kushana period. The mound is of U shaped roughly 270 m. from north and south and 215 m east to west. The accumulation of debries is 2.5 m. thick.

18] Sulchani :-

Location :- The ancient mound close to village Sulchani is situated by the side of bullock – card road going from Kagasar to Sulchani. It is approx. 14 km away to south east of Rakhigarhi. The modern village of Sulchani is 2-5 km ahead of this ancient mound.

The Mound :- As this mound is located far away from village moreover it is undisturbed. On the southern and western sides it is cut down by agricultural fields. Otherwise surface of this mound is covered by grass and other small plants. posherds are scattered all over the surface of this mound. The colour of soil whitish Gary which differs from yellowish brown soil of surrounding fields. In southwestern periphery of this

mound few brick – bats of burnt bricks are seen. The size of thus bricks approx. to be 28 x 14-x 7 cm.

This mound is spread 243 mtrs. North to South and 168 m East to West. This mound rises 4.5 m. high from the ground level.

Ceramic Assemblage :- Potsherds sampled from the surface of this mound shows the existence of following cultures –I / Late Harappan. II / OCP and III / Kushana.

I / These sherds are found in south and west. These sherds are dominated by red ware pottery. Some of these sherds have paintings in black colours. Horizontal bands, horizontal bands with jalli pattern, bowls of narrow base, storage jar, globular pots, basins are the main shapes present here.

II / Very few sherds of ochre coloured pottery are found. Lid, small nase with out turning flat rim, bowls.

III /Kushana :- Polished red ware is present on this mound some of the rims of these sherds have increased marks of nail impression. Pots with short neck, bowl with flat out turning rim are the main shapes.

Antiquities :- A circular terracotta cake and few sling ball made in stone are reported here.

19] Kagasar :-

Location :- The ancient mound close to village Kagasar is 16.5 km to the south east of Rakhigarhi.

Mound :- As this mound is just across the village Kagasar-Baganwala road opposite to present Kagasar village it is almost reduced to ground level by the agricultural activity. Hence it is not possible to determine the dimensions of this mound. The potsherds are found aprox. 200 x 200 m. area. The villagers also confirm existence of mound where is been employed by them for plastering the walls of their houses and other purposes.

Ceramic assemblage :- Found of the surface of this mound indicate the presence of I / Late Harappan and II / OCP deposit.

I / This period is represented by the sherds of thick storage jar of red ware with externally projected everted rims, medium sized globular pots.

II / ochere coloured pottery is the dominant ware found here. Some of the sherds are quite thick in section vase with flared out rim, convex sided bowls, basins, and dish on stand are the main varieties in shape.

20] Sarasana :-

In season 1998-99 explorations were carried out by Mr. Sameer Deewan under the guidance of Dr. Amrendra Nath. Sameer Deewan has reported two habitation mounds namely Sarsana and Gyanpura.

Location :- Sarsana is located 15 km away to the north west of Rakhigarhi.

Mound :- The size of mound is 350 m. N-S and 310 m E-W and approx. habitation deposit is 3 m. Other details of this mound are not known. Only existence of Mature Harappan deposit is conformed.

21]　Gyanpura :-

Location :- The ancient mound close to village Gyanpura is 1 km. Away from Rakhigarhi towards the North –West. This mound is approachable by a unmettaled road going from village to its south.

Mound :- The mound seems to have been disturbed by the villagers. The mound is spread 550 m. E-W and 360 m N-S. The habitation deposit is 2.5 m thick. Again Mature Harappan deposit is reported; but details of other cultures are not known.

Appendix 2

Defining the Economical Space of Harappan Rakhigarhi: An Interface of Local Subsistence Mechanism and Geologic Provenience Studies

Subsistence strategy of population reflected in archaeological record can be determined by taking into consideration exploitation of resources by the same populous. Eric Higgs and Claudio Vita-Finzi (1970: 1-37) pioneered the concept of *site catchment analysis* in archaeology. "Catchment" is originally a geomorphological term denoting the area from which all water flowing into an individual river, lake or basin is derived. Higgs and Vita-Finzi modified this spatial concept as a way to delineate the extent of the area from which the inhabitants of an archaeological site procured resources. Doing so provides researchers with a way to examine and better understand how residents of an ancient site exploited their surrounding environment and defined their settlement's territories (social and political as well as economic). In Indian archaeology, site catchment analysis has been applied successfully at individual sites like Inamgoan (Pappu 1988: 107-120), Kuntasi (pappu 1996: 107-120) and Balathal (Das Gupta 2006: 70-74), and in a modified regional context in the Tapi (Tapti) basin of Maharashtra (Pappu and Shinde 1990: 307-316). Taking inspiration from these studies, Nath and Garge (2014: 33-45) delineated and analysed the site catchment area of the Harappan metropolis of Rakhigarhi, (29°17'30" N; 76°06'50" E) located in the Saraswati-Drishadvati divide.

In the absence of historical accounts of trade, *geologic provenience studies* can provide compelling evidence that an exchange network once existed between the ancient inhabitants of a region where a stone or metal artefact entered the archaeological record and those in the region where the raw material the artefact is composed of originated. The soundest provenience determinations are ones based on analyses of

artefacts composed of unadulterated rock or mineral rather than processed metal, which could contain metal from multiple sources as well as various alloys and additives. With unadulterated stone, "specific types of raw materials can be related to an objective geologic reality that is derived from natural (as opposed to cultural) processes" (Odess 1998: 419). There have been several major broad-scale studies (Fentress 1976; Lahiri 1992; Ratnagar 2004) of Harappan trade networks that examined multiple varieties of stone and metal to construct models of protohistoric resource access and exchange. Randall Law (2011) built upon these earlier studies by using a variety of analytical methods, conducting large-scale direct comparison of artefacts from Harappan sites to samples collected from potential stone and metal sources throughout the greater Indus region. Recently, he was invited by the Rakhigarhi's excavator, Amarendra Nath, to begin geologic provenience studies of that site's stone and metal artefact assemblage (Nath *et al. in press).*

Site catchment analysis and geologic provenience studies are complementary efforts and, in this paper, we attempt to interface both approaches. This is somewhat similar to what Catherine Jarrige and Maurizio Tosi's (1981: 115-142) did in their paper entitled "The Natural Resources of Mundigak." There they broadly defined the "economical space" (or, per Vita-Finzi and Higgs 1970, the "economic range") of that Bronze Age site in the Indo-Iranian borderlands (southern Afghanistan) by listing the probable sources for the full range of raw materials discovered during excavations there. Here we have adopted a similar broad-scale perspective for this effort to define the catchment area or "economical space" of Rakhigarhi.

The Site of Rakhigarhi

The site of Rakhigarhi (Fig. 1) was excavated for three seasons - 1997-98 (Nath 1998: 39-45), 1998-99 (Nath 1999: 46-49) and 1999-2000 (Nath 2001: 43-46). Multiple mounds were identified and numbered as RGR 1 through RGR 7. Of these mounds, RGR 1, RGR 2 and RGR 6

revealed an occupation of pre-formative stage followed by the Early Harappan settlement whereas RGR 7 is a necropolis. Radiometric dates, obtained from RGR 1, RGR 2 and RGR 6, are tabulated below:

Table 1: Radiometric dates from Rakhigarhi

Period	S. No.	BSIP Ref.	Ref. No.	Radiocarbon age (Yrs DP)	Calibrated Age (Yrs DP)	Sample CO2
Pre-formative	s- 4173	BS - 3318	No. 58, RGR - 6, 4.96 m	5640 ± 110	6420 ± 110	96.3
Pre-formative	S -4187	BS - 3341	No. 51, RGR - 6, 4.23 m	5440 ± 290	6230 ± 320	18.3
Early Harappan	S- 4190	BS - 3344	No. 46, RGR - 1	4570 ± 100	5230 ± 60	39.4
Early Harappan	S- 4180	BS - 3324	No. 213, RGR - 2,8.45 m	5200 ± 100	5910 ±130	98.5
Mature Harappan	S- 4215	BS - 3368	No. 78, RGR - 2, 6.40 m	4040 ± 90	4560 ± 90	44.8
Mature Harappan	S- 4237	BS - 3389	No. 187, RGR - 2, 5.60 - 5.90m	3900 ± 110	4320 ± 90	33.0

With regard to Harappans dwelling at Rakhigarhi and elsewhere in the Sarasvati-Drishadvati Divide River region, a pattern has been noticed identifying an antecedent cultural horizon termed the Hakra ware culture (Lal *et al.* 2003). The downstream portions of the Sarasvati-Drishadvati are known as Hakra in the Cholistan desert. There the Hakra ware culture horizon was defined based purely on explored data (Mughal 1997) and those data are reminiscent of the excavated material from Sothi (Ghosh 1952: 98-106). A case can be made for changing the nomenclature from Hakra ware culture to Sothi culture for the Early Harappan horizon

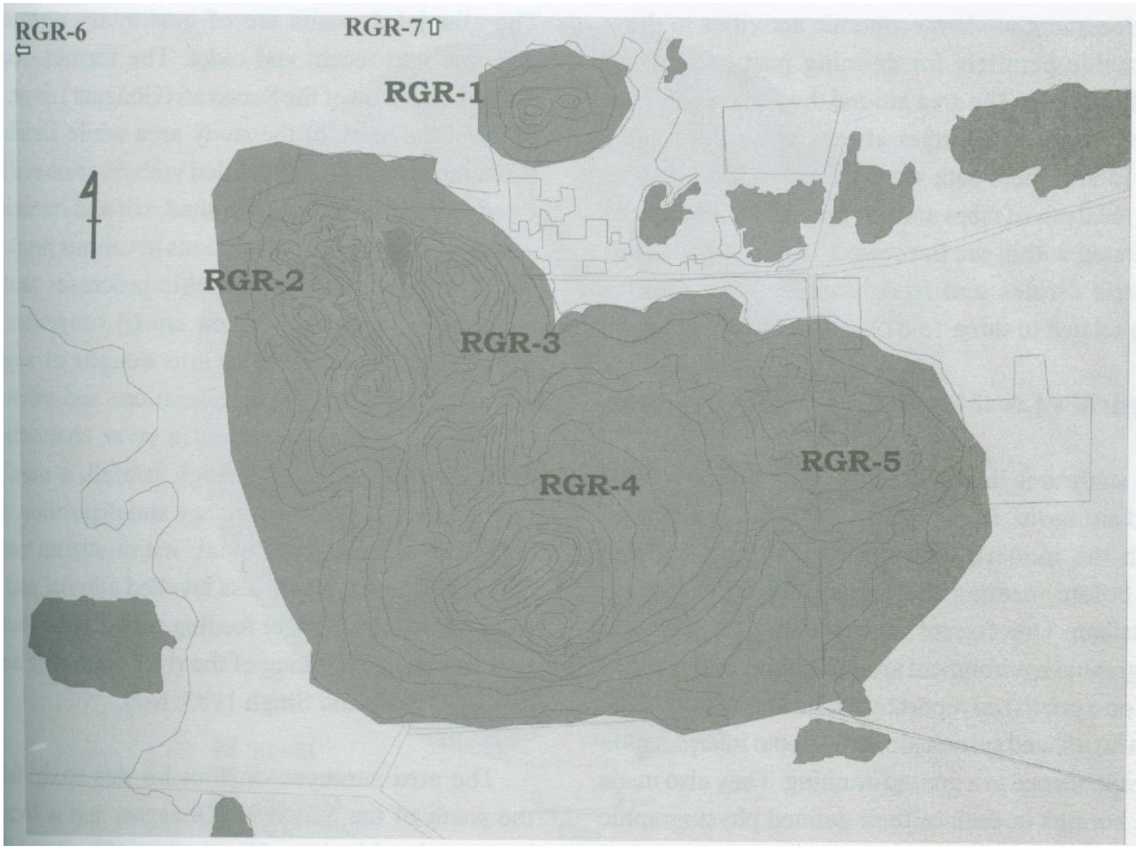


Fig. 1: Dispersal of mounds with counters, Rakhigarhi, Haryana

in the Sarasvati-Drishadvati Divide. Therefore the pre- formative stage noticed at Rakhigarhi below the Early Harappan horizon will be designated here as Sothi Phase on similar lines as Ravi Phase at Harappa (Kenoyer 2011: 1-18). Rakhigarhi is one of the largest sites located in the eastern domain of Harappan empire and can reasonably be identified as the 'Provincial Capital' of that domain. The site lies in a dense settlement zone that is sustained by surplus agricultural produce, forest, and other resources. The limited excavation has provided rich dividends for in-depth site catchment analysis and geologic provenience studies.

Site Catchment Analysis Methodologies

The aim of site catchment analysis at Rakhigarhi was to determine function of the Harappan city (Nath and Garge 2014: 33-45) and its

contemporary satellite settlements and to understand the exploitation of resources by this ancient community through the study of zone-wise distribution of said resources. This involved examining factors like climate, landform, drainage, flora, fauna and soil. Present day environmental conditions may not be applicable to those of Harappan era, hence possible environmental changes were taken into consideration.

Extensive research was carried out in and around Rakhigarhi in order to (i) locate satellite settlements spread around the site along the palaeo-channels of the Drishadvati (Chautang) and its tributaries, (ii) to define different catchment areas based on the landforms and reliefs, flora, fauna, soil types, agriculture, modern land use pattern, mineral resources and drainage system and (iii) to document modem economic activities to draw ethnographic parallels for defining past patterns of human behaviour. The area around the site was divided into three concentric circles at regular intervals of 5, 10 and 15 km. Field data were generated through foot surveys, analysis of maps and published data. The results were plotted within the framework of the hypothetical concentric circles and have provided meaningful insights related to three-fold objectives noted above.

Rakhigarhi's Local Physiographic Environment

The study area lies on the flood plains of Sarasvati-Drishadvati basin. In the past, the Drishadvati flowed through the modem districts of Kamal, Jind and Hissar before meeting the Sarasvati near Suratgarh in Rajasthan. Our current understanding of the local physiographic environment around Rakhigarhi is based largely on a published report by Ahuja and Singh (1983: 3-17), who utilized systematic aerial photo interpretation in correspondence to a ground-truthing. They also made several borings in each of their defined physiographic units which were subjected to thorough geophysical characterization.

Topographically, this area is flat, monotonous upland terrain that is a part of the alluvial of Satluj-Yamuna plain; the western portion of which gradually transitions into the Thar Desert. Prominent features are aeolian sand deposits of variable shapes and thicknesses overlying the Pleistocene alluvium. The patches of older alluvium are either exposed or occur at shallow depth beneath a veneer of sand in *tats* or topographic depressions enclosed by fossilized dunes known as *tibbas.* Silted-up river channels with continuous or intermittent levee undulations occupy a relatively lower position. The general gradient of the terrain is from north-east to south-west and then west.

The bed-rock of this area is deeply buried and is wholly concealed under alluvial and aeolian deposits. The alluvial deposits are of quaternary age and are divisible into recent and older. The former occurs in active flood plain of the Sarasvati (Ghaggar) river, which flows in the north of the study area while Drishadvati (Chautang) to the south is filled with riverine sediments comprising clay mixed with sand, silt and occasionally gravel. Calcareous concentrations in various proportions are also found. The geomorphic processes that have been acting upon this region are (i) orogenic: uplift of the Himalayas resulting into troughs or sags, (ii) fluvio-glacial: Pleistocene glaciations and subsequent melting of glaciers resulted in river channels, (iii) fluviatile (pluvial): during high rainfall, a number of rivers flowing, braided drainage and deposition, filling up of the trough, (iv) fluvial: major stream network developed on a more or less levelled alluvial plain and (v) fluvio-aeolin: glacier feeding cut off at the source of the streams and choking of the river north with aeolian deposit (Ahuja and Singh 1983: 6-7).

The area surveyed on foot for this study falls to the south of the Sarasvati (Ghaggar) and is localised between the old relics of Drishadvati (Chautang) River, which flows in both the upper and lower part of the present study area. The river drains a large column of the flood flow during the rainy season. This takes place mostly between July through

September. It generally remains dry in summer. However, the inflow of the ground water remains active as late as October. This water source stimulated the early colonisers to occupy this fertile terrain. At present, there is no perennial or seasonal stream flowing through the confines of study area. In the absence of major or minor rivers, canal irrigation has become the main solution for modem day agriculture. For domestic purposes, people mostly depend upon tube wells and palaeo-lakes and tanks. The depth of water table ranges from 0.83 to 39.80 m. The subsoil water of this area is generally brackish due to the over use of chemicals and fertilizers for high yields. Sweet water can be obtained from wells located in areas having ameliorating factors like existing or old stream courses and long standing irrigation seepage from *kachcha* tanks.

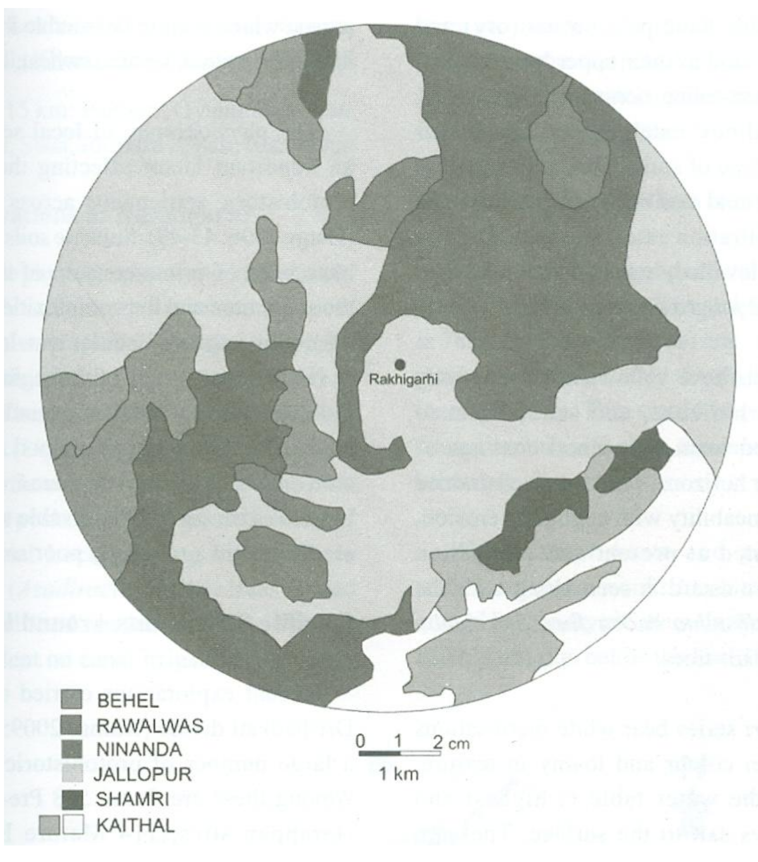


Fig. 2: Soil series around Rakhigarhi

There are five principal soil series around Rakhigarhi (Fig. 2): the Behel, Rawalwas, Ninanda, Jallopur, Sharnri and Kaithal series.

The soils of the *Behel* series have yellowish brown sandy upper horizons with higher evapo-transpiration and brown to dark yellowish brown, non-saline, non- sodic, non-sticky, non-plastic lower horizons. These are partially stabilized to un-stabilized, severely eroded, excessively drained sand dunes of aeolian nature. Hence these soils have been placed under an aridic moister regime. At present gram and *bajara* is marginally cultivated and grasses grow there such as *dub (Cynodon dactylon (L.) Pers.)* and *dabh (Desmostachya bipinnatta (L.) Stapf.),* trees like *jand (Prosopis cineraria (L) Druce.) andjal or van (Salvadora oleoides Decne).*

The soils of the *Rawalwas* series are loamy sand, consisting of alluvium covered with Aeolian sediments. These soils are slightly eroded, well drained with moderate infiltration. Occasionally *Bajara* and gram cultivation is possible during years of favourable rainfall. Grasses like *dabh* and *jal* and *kikar (Acacia nilotica (L) Delila ex Del.)* trees grow naturally on these soils.

Ninanda series soils have pale brown (dry) and brown (moist) loamy sand in their upper horizons and brown to dark brown non-saline, non-sodie, sandy loam, weakly developed and moderately calcareous in their lower horizons. This type of soil is generally alluvium covered with aeolian sand and normally well drained with a moderate infiltration rate. They are slightly eroded and presently levelled, irrigated and cultivated with cotton. *Kikar andjal* grow naturally here.

Jallopur series soils have yellowish brown, sandy loam in their upper horizons, and sandy loam to moderately developed loam over flood coatings of alluvium in their lower horizons. These are well drained soils of moderate permeability with negligible erosion. They are well irrigated at present and cultivation of wheat, gram, and mustard is seen along with the raising of *neem (Azadirachta indica Juss. Syn. Melia azadirachta L.)* and *kikar* trees.

Soils of the *Shamri* series bear white incrustations of salts, are brown in colour and loamy in texture. They occur where the water table is highest and capillary action draws salt to the surface. They are categorised as waste land and support only *Luni* or *Bui (suaedafructicose)* weed.

Soils under the *Kaithal* series are dominated by aeolian sands and have a high infiltration rate and so are not preferred for cultivation. Occasional grasses are noticed.

The overall area experiences a subtropical, continental secondary, monsoonal type of climate with a prolonged hot period from March to October and fairly cool winters. Extreme temperatures and scanty rainfall characterizes the climate of the study area. The maximum temperature during the summer season ranges between 45° and 48° C. January is generally the coldest month; temperature varies from 21 ° to 7° C. An average soil temperature of 16° to 21 ° C exists during the winter season which is quite favourable for cultivation of crops like *guara, raya,* sesame, wheat, barley, peas etc.

The physiography of local soil types was clearly an important factor affecting the distribution of the protohistoric settlements across the Chautang basin (Garge 2006: 43-49). Suitable soils for agriculture would have been of prime concern of the first colonisers in the study area and the complexities of soil morphology no doubt impacted settlement location. The macro-environmental survey of the region around Rakhigarhi indicates that most ancient mounds were situated on the edge of the Chautang river flood zone on good quality cultivable soils. However, there are several sites that are located in moderately cultivable soils and few of them are located in a relatively poor soil quality segments.

Satellite Settlements around Rakhigarhi

Recent explorations carried out in the Sarasvati- Drishadvati divide (Kumar 2009: 1-75) have revealed a large number of protohistoric period

settlements. Among these are found 558 Pre-formative and Early Harappan sites, 114 Mature Harappan sites and 1168 Late Harappan sites (Danino 2010: 139-41). Many of these relic settlements are located along the watercourses of the region and bear a testimony to the ancients' knowledge of water harvesting and irrigation. The site of Rakhigarhi lies between two channels forming a peninsular setting that is interspaced with green pasture land and gallery forests. For the catchment analysis, the area around the site was sub-divided into three concentric circles at a range of 5, 10 and 15 km radius (Fig. 3). Twenty-three satellite sites (listed below) were identified during the foot surveys of these zones. A twenty-fourth site, Masudpur (Masaudpur) was identified later by Petrie and others (2009: 41).

1. Sites within a 5 km radius of Rakhigarhi: Garnra, Budana, Haibatpur, Lohari Ragho 3
2. Sites from 5 to 10 km: Lohari Ragho 1, Lohari Ragho 2, Kheri Lochab-Jalab, Milakpur, Kinnar, Sotha, Gandaswala Khera, Nara, Mirchpur, Gunkali
3. Sites from 10 to 15 km: Panhari, Gyanpura, Sotha, Kagsar, Su1chani, Sisai, Rajpura 2, Pali, Masudpur.

Catchment Observations at Rakhigarhi

Observations of the physiography at and immediately adjacent to Rakhigarhi indicates that resources required for basic subsistence were available at the settlement itself. The alluvial plain at the site is categorised as Class I fertile land. There are traditional references to the land being fertile *(Urjasvati),* irrigated *(Payasvati)* and high-yielding *(Susuma).* The soil, which is a sandy loam, contains pockets of clay for

ceramics and house building material. Local growing *Kikar (Acacia arabica)* and *Neem (Azadiracta indica)* trees would have been quite useful for domestic activities. Modem agriculture is dependent on canal irrigation. However, there are number of palaeo-ponds and palaeo-channels visible around the periphery of Rakhigarhi that most likely served its residents as water sources for drinking, fishing and agriculture.

Catchment Observations from Rakhigarhi to 5 km

The 5 km radius zone around Rakhigarhi covers an area of 7,857 hectares. The arable land within this zone is 78%, (6128.46 hectares) and, like at the site itself, is predominantly a highly fertile aeolian-derived sandy loam (Plate 1). This would have provided ample land for agriculture and, thus, the capacity to support a large urban population.

Agricultural waste and grazing on fallow or unfarmed areas would have easily supported local animal husbandry practices. In the pre-formative stage at Rakhigarhi (i.e. below the Early Harappan horizon) are

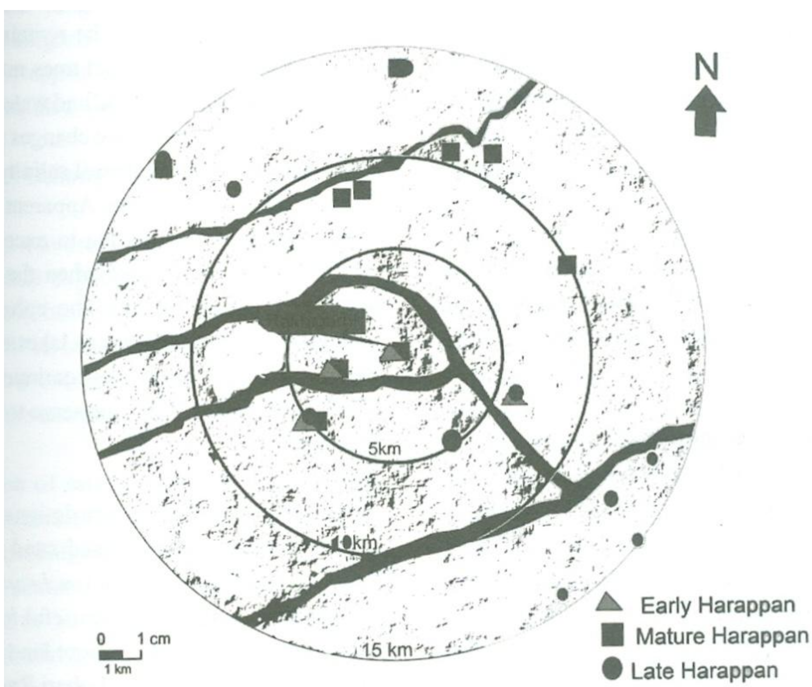


Fig. 3: Satellite round Rakhigarhi

found the remains of domesticated cattle, zebu, buffalo, goat, sheep and pig. Cattle bones have outnumbered all other animal bones, including those of wild varieties, by a large margin. Ethno-archaeological observations at the site indicate that modem villagers there preferred to breed buffalo over cow, goat and sheep. The excavations at the site, incidentally, have recovered high percentage of buffalo bones from all occupation levels. It is therefore believed that residents of Rakhigarhi relied heavily on dairy products throughout their occupation, which could be characterized as an incipient stage of the 'white revolution' of the postmodern period.

Archaeobotanical remains from Sarasvati-Drishadvati Divide sites like Kunal (Acharya 2008), Balu *(JAR* 1996-97), Bhirrana (Rao *et al.* 2004-5:66), and Kalibangan (Lal *et al.* 2003) have revealed a two crop pattern. The winter or *rabi* crops are barley, wheat, peas, lentils, chick-pea etc., while summer or *kharif* ones are rice, millets, dates, gram, cotton etc. From ethnographic parallels, modem farmers dwelling at Rakhigarhi are active on lands 4 to 5 km from the city. The first season of excavations there established the existence of wheat, barley in the Mature Harappan period and seeds of *bathua (Chenopodium)* in the Early Harappan period. Pieces of wattle-and-daub embedded with rice husks have also been recovered from the Early Harappan horizon and are currently under examination by K.S. Saraswat. These archaeo-botanical data demonstrate a winter and summer multi-cropping strategy at the ancient site.

There are four small ancient sites located within the 5 km radius zone. Gamada, Haibatpur and Lohari Ragho 3 go back to the Early Harappan period. The settlement at Budana emerged during the Mature Harappan stage. These have been interpreted as satellite settlements. Haibatpur apparently exploited the pasture land which covers almost 12% of the total land of the area in this

zone. Similarly, Lohari Ragho 3 lies in a small patch of aeolian sand to the south-west ofRakhigarhi, which is generally unsuitable for agriculture. Local grasses like *dab (Sachrarum Spp)* and *doof(cyndondactylon)* suggest the pastoral orientation of these sites. Surface investigations at Lohari Ragho 3 reveal concentrations of white circular patches of ash (kilns) that are spaced at regular intervals and have average diameters of around 1 m. As many as 17 such kilns, which are associated with over-fired terracotta cakes and cracked burnt bones, have been noticed in a compact area of 75 X 50 m. Another important finding is the presence of collumela of *Turbinellapyrum* indicating shell craft activity (Garge 2006: 43-49). These data indicate industrial character of the site besides the agro-pastoral connection.

Catchment Observations from 5 to 10 km

The total area covered when the catchment zone around Rakhigarhi is expanded from a 5 to 10 km radius zone is 31,416 hectares. The arable land decreases to 23% while land suitable for pastoral uses increases almost doubles to 54%. The remaining 14% of land is covered small bushes and trees may have served as hunting ground. Barren land and water bodies cover 9% of the total area. Some of the changes may be due in part to an increased degree of soil salinity in the expanded zone during the modem era. Apparently the degradation in the quality of soil is due to excessive agriculture, which was not as intense when the Drishadvati was active, *circa* 2000 BCE. The ephemeral nature of that water course gave rise to lakes and ponds around which agricultural activities continued. Modem relicts of palaeo-pond's in this zone serve to corroborate such assumptions.

Nearly a quarter of the area designated as pastureland is covered by semi-fossilised sand dunes. On these dunes grow grasses like *dab (sachrarum Spp)* and *doof (cyndondactylon),* which are useful for cattle or

sheep-goat grazing. Across the pasture land are located small sites like Lohari Ragho 1, Lohari Ragho 2 and Kheri-Lochab, which originated during the Early Harappan period. These settlements are situated quite close to the patches containing the shrubs *(calotropisprocera) Jhar Beri (Zizyphus Spp.)* and trees like *Jalab (Slvodra oleodides)* and *Jand (prospis Spp)* that may have served as hunting grounds. Lohari Ragho 1 is very close to the flood-plain zone of Chautang and so agro-pastoral activities at this site cannot be ruled out. Though Lohari Ragho 2 and 3 are located on non-agricultural lands, some of the population might have been engaged in pastoral activities while others in craft activities (Garge 2006: 43-49).

There are a number of settlements in this expanded zone that came into existence during the Mature Harappan period. Milakapur, Kinnar, Nara, Gunkali and Mirchpur thrived only during the Mature Harappan period, while settlements at Gandaswala, Sotha, Kinnar, Nara and Mirchpur continued up to the Late Harappan period. In the modern era, there are several burnt bricks production kilns near villages located in this zone. Burnt bricks used at Rakhigarhi, which started appearing during the Early Harappan horizon, may likewise have been produced some distance from the site in this zone.

Catchment Observations from 10 to 15 km

The total area covered when the zone around Rakhigarhi is further expanded from a 10 to 15 km radius zone is 70,686 hectares. The total percentage of arable land is now 47%, while the percentage of pastoral land decreases to 38%. Land covered by bushes is 9% and 7% falls into the category of barren land.

The distribution of satellite sites between 10 km to 15 km is concentrated in areas to the northwest and southwest of Rakhigarhi. The sites located in the northwest are of mature and Late Harappan origin while sites located in the southwest show a continuity of occupation from early, mature and late phase of the Harappan culture. Both the clusters

of sites are located on arable land. The sites in northwest such as Panhari, Gyanpura, Sotha, Kagsar and Sulchani and those in southwest namely Sisai 1, 2, 3, Rajpura 2 and Pali are situated in class one agricultural land. A cluster of small sized early, mature and Late Harappan settlements around Masudpur falls within 12 to 15 km southwest of Rakhigarhi. It is located in the upper reaches of streams which irrigate the area. The source of these parallel running streams has been blocked due to the westerly accumulation of sand dunes. These and other palaeo-channels have contributed to agro-pastoral character of the site. The Late Harappan settlements could have survived on these water bodies when Drishadvati was drying up.

Geologic Provenience Studies

In stark contrast to the rich agro-pastoral potential of Rakhigahri's local catchment area, raw material resources were, with some notable exceptions, completely absent there. Those exceptions are clay (for ceramics and bricks), animal products (bone, horn and ivory) and timber, the last of which, even ifnot growing locally, could possibly be obtained opportunistically as logs carried on rivers flowing into the area from the distant Himalayan foothills. Everything else at the site had to have been transported there from sources outside of the local catchment area. Marine shell, which was being worked at Rakhigarhi and the satellite settlement of Lohari Ragho by the Early Harappan Period (Garge 2006: 43-49; Nath 1998: 39-45), was obviously obtained through trade networks extending all the way to the ocean - most probably the Arabian Sea coast of Gujarat some 800 km to the south. Most stone and metal resources could be acquired from localities much nearer than that to the site. The question is where were those sources? The closest rock outcrops of any kind to lie approximately 50 to 70 km south of Rakhigarhi. For more significant and varied sources of stone and metal one would have had to travel several hundred kilometres into the Himalayas or the northern Aravalli Range. Geologic provenience studies

rock and mineral artefacts can allow us to identify the sources of those materials. By doing so, we can better define the extent of Rakhigarhi's catchment area.

The team of excavators at Rakhigarhi painstakingly recorded each and every stone and metal object recovered in the course of three field campaigns at the site. This database of artefacts is enormous and geologic provenience studies, which began in 2008[1], are ongoing. The preliminary findings of those studies (Nath *et al. in press)* are summarized below for each raw material type examined to date.

Steatite

Steatite - a rock composed mainly of the mineral talc - was one of the most important types of stone in the Harappan corpus of raw materials. It was used to create common items, such as disc beads, as well important objects like stamp seals and inscribed tablets. Although steatite occurrences are found in many parts of South Asia (Law 2002: 158-69), instrumental neutron activation analysis (INAA) of artefacts from sites across the Indus Civilization (Law 2011: chapter 7) indicate that Harappans mainly acquired this type of stone from sources located in what today is northern Pakistan, primarily those in the Hazara District. Deposits in some other areas, such as northern Rajasthan, were also exploited but to much more limited degree.

INAA is a highly accurate and precise method for quantifying the major, minor and trace element compositions of materials has been employed by researchers around the world in efforts to identify the geologic sources of a wide range of archaeological stone. In brief, INAA involves the irradiation (or activation) of elements within materials by exposing them to a neutron flux. Following varying periods of decay, the gamma ray emissions they produce are detected and counted. After the results are screened of elements that failed to be detected in all samples or had high count-rate standard deviations, the data is evaluated using canonical discriminate analysis (CDA). During CDA, linear combinations

of variables called *discriminate functions* are generated that produce a maximum degree of separation (discrimination) between various defined groups of cases, which in this study are the individual sets of samples which are collected from different geologic sources in India and Pakistan. Artefacts are plotted as ungrouped cases and assigned to the group (geologic deposit) whose centre (or centroid) in multidimensional space they are nearest.

Minute samples from four steatite artefacts were subjected to INAA. Two of the four were pieces of unheated manufacturing debris. A third sample was taken from a battered block of steatite that, in all probability, was a blank or rough out for a stamp seal. Loose material from a damaged area of the block was collected for analysis. The final artefact sampled was a fragment of a unicorn stamp seal. A small amount of the greyish-green steatite exposed in its broken section was carefully removed for analysis. All of the artefacts are from the mound at Rakhigarhi designated RGR-2. The two debris fragments are surface finds while the seal blank and seal fragment are from Mature Harappan levels.

Preparation of the Rakhigarhi steatite samples for INAA took place at the Laboratory for Archaeological Chemistry, Department of Anthropology, University of Wisconsin- Madison. Analysis was conducted at the University of Wisconsin's Nuclear Reactor (UWNR) research facility by the team supervised by lab director Robert Agasie. The elemental data generated for the four artefact samples were compared using CDA to a database of geologic samples collected from 37 steatite sources across India and Pakistan. The predicted group membership (source) for three of the artefacts (a debris fragment, the seal blank (plate 2) and the broken seal) was one of the steatite deposits located in the Hazara District, Khyber Pakhtunkhwa Province or KPP (formerly known as the North-West Frontier Province or NWFP), Pakistan. The fourth artefact (one of the two debris fragments) was assigned membership among a group of

geologic samples from the Daradar steatite deposit in the Safed Koh Range of the Kurram Agency, Federally Administered Tribal Areas (FATA), Pakistan.

Although only four steatite artefacts from Rakhigarhi were analysed, the results strongly suggest that residents of the site were part ofthe same extensive acquisition! distribution network for this raw material as their fellow Harappans at other Harappan Civilization cities. Stone from sources in northern Pakistan makes up 95% of such artefacts analysed from Harappa and approximately two-thirds of those tested from Mohenjo-daro and Dholavira. The percentage from Rakhigarhi presently stands at 100% but that is almost certain to change when a larger sample from the site is tested. Steatite from sources in the Alwar and Jhunjhunu districts of northern Rajasthan has been identified at Harappa and Mohenjo-daro as well as at Mitathal (Prabhakar *et al.* 2010: 54-61). Given Rakhigarhi's relative proximity to that region, it is highly probable that stone from deposits there will eventually be detected in its assemblage.

One may ask why would residents ofRakhigarhi and other Harappan sites predominately use steatite from distant sources in northern Pakistan when there were other, often much closer deposits of the material. The reason is that stone from deposits in that region of the northern Subcontinent, especially those in the Hazara District, possessed physical qualities that Harappans sought - that is, they are of the highest quality for bead and seal-making and, most importantly, they become pure white when heat-treated. Extensive deposits of good quality steatite occurs in the Himalayas and the Aravallis but experimental heating (Law 2011: Appendix 7.16) of samples from those sources indicates that raw material from them rarely turn white.

Agate and Carnelian

Ornaments (mostly beads) made from the translucent reddish-orange variety of agate known as *carnelian* are almost as ubiquitous at

Harappan settlements as steatite objects. Geologic provenience studies of carnelian artefacts from a half dozen sites across the Harappan Civilization (Law 2011: chapter 8) appear to confirm what researchers have long suspected - i.e., that this variety of stone was mainly derived from deposits located in the Gujarat region. It seems, however, that the agate deposits Harappans primarily exploited occur in northern Gujarat rather than, as was widely assumed, the more famous source at Ratanpur in the south-eastern part of that state. Agate-carnelian artefacts from Rakhigarhi were examined in order to determine if the same acquisition pattern would be evident at that site, which of all Harappan cities was the most far removed from the Gujarat sources.

Five carnelian artefacts (nodule fragments and non-diagnostic bead making debris) recovered from the surface or near surface levels on mound RGR-2, were selected for INAA. Using CDA, the elemental data generated were compared to a database of geologic samples from three agate sources in Gujarat and one in eastern Iran (Plate 3). The Gujarat sources include the deposit at Khandek in eastern Kachchh (some 70 km from the Harappan city of Dholavira), the extensive agate beds on Mardak Bet in the Little Rann of Kachchh (105 km from Dholavira), and the famous agate mines of Ratanpur (390 km from Dholavira). The source in Iran is represented by proxy using carnelian nodule fragments recovered from the protohistoric site ofShahr-I Sokhta. All five of the Rakhigarhi artefacts were assigned to one of the Gujarat sources - three to the Khandek deposit, one to the Mardak Bet deposit and one to the Ratanpur mines. Although they represent an extremely small sample of agate-carnelian bead production debris at the site, the five provenience assignments do correspond to the general acquisition pattern for this raw material detected at multiple Harappan sites, which is that most of the carnelian utilized came from sources in northern Gujarat while only minor amounts originated in the more famous (but more distant) mines of Ratanpur. These results should be treated cautiously, however, as

there are many agate-carnelian sources across South Asia and beyond that remain to be characterized. This includes occurrences closer to Rakhigarhi in the Vindhyas. It is entirely possible that some of artefacts were derived from a source or sources not yet represented in the geologic database.

Lead and Silver

Lead and silver objects have been recovered at sites across the Harappan domain. Occurrences oflead, many of which are viably *argentiferous*-meaning that they contain an extractable quantity of the precious metal silver-are found in numerous parts of the greater Indus Valley region as well as areas outside of it with which the Harappans are known to have had long-distance contacts. Archaeologists have long employed lead (Pb) isotope analysis in efforts to identify the geologic sources of artefacts composed of or containing that metal. Using this method, a large-scale provenience study was initiated in 2002 and has now grown to include samples from over three-dozen geologic sources and artefacts from eight Harappan sites (Law and Burton 2006: 181-185; Law and Burton 2008: 14-15; Law 2011: chapter 12). In the light of ongoing research, a picture of lead and silver acquisition networks during the Harappan Period has emerged. It appears that people across the Harappan Civilization primarily acquired these metals from deposits in southern Baluchistan. However, residents of Harappa and Dholavira also utilized lead and/or silver nearer sources (deposits in Jammu and Kashmir, and northern Gujarat respectively). Five artefacts from the Rakhigarhi collection were isotopically assayed in order to determine if a similar acquisition pattern existed there.

The first object sampled was a lead ingot inscribed with Harappan characters on both sides (plate 4). A small prism-shaped piece of lead was also assayed. The remaining three artefacts sampled were silver ornaments - two hoops and a small disc (Plate 5). All of the objects were recovered from excavations on mound RGR-2, save the prism-shaped

piece of lead, which was from mound RGR-4. In order to extract lead from the artefacts for isotopic analysis, a solution was prepared that consisted of ultrapure water and 0.05% dissolved EDTA, which is a hexadentate chelating agent that forms coordinate bonds with lead atoms. Each artefact was immersed in the solution for five minutes, which is usually sufficient to extract lead atoms in concentrations from 100 ppb to as much as 100 ppm - orders of magnitude more than required for isotopic analysis. At that point, the lead-enriched solutions were poured into sample vials for return to the lab. The artefacts were rinsed in ultrapure water, allowed to dry, and then returned to their place of storage. The brief immersion time in the sampling solution did not result in any macroscopic alteration whatsoever of the artefacts.

The artefact sample solutions were sent to the Keck Isotope Laboratory at the University of California-Santa Cruz where they were analysed by Dr. Emily Peterman on a Thermo Scientific NEPTUNE multiple-collector inductively coupled-plasma magnetic-sector mass-spectrometer (MC-ICP-MS). The results were compared to the database ofPb isotope values for South Asian lead and lead-silver ore deposits. Three of the artefacts - the inscribed lead ingot and both silver hoops - plotted within the lead isotope field defined by geologic samples from the southern Baluchistan sources. The silver disc and the prism-shaped lead piece fall somewhat away from that field in a part of the plot that is not, at present, represented by a lead source. These two artefacts could either be made of metal derived from a deposit (or deposits) not in the database or composed of metal from two or more sources. The latter possibility might have given the objects isotopic characteristics that cause them to plot along a "mixing line" between a southern Baluchistan deposit and an unknown source or sources.

Although only five artefacts were analysed, the results suggest that the lead and silver acquisition patterns of Rakhigarhi residents were similar to those of their contemporaries at Harappa, Mohenjo-daro and

Dholavira. The argentiferous lead deposits of southern Baluchistan seem to have been the primary source of those metals but there are indications that secondary, alternate sources were also exploited. In the case of Rakhigarhi, that unknown source(s) is unclear at present.

Grinding-stones

Grinding stones - querns, mulIers, mortars, pestles, whetstones, etc. - were essential utilitarian tools that would have been used daily for processing foods as well as for performing numerous kinds of craft activities. Moreover, they were among the bulkiest (that is to say, heaviest and largest) stone objects acquired by Harappans. Providing a steady supply of grinding stones to the urban population dwelling at Rakhigarhi (Plate 6), where there are no local stone resources whatsoever, would have necessarily required a significant expenditure of time and energy.

For the grinding stone study at the site ofHarappa, the entire sub-assemblage was directly compared to samples collected from potential geologic sources in and around the upper Harappan Basin (Law 2011: chapter 5). The general source area for around 70% of the artefacts was determinable based on an assortment of qualitative physical criteria including rock sub-variety, colour, texture, grain size, patterning, visible inclusions, degree of silicification and toughness. An identical study was initiated for the Rakhigarhi grinding stones. Over the five days exactly 665 examples of querns, mortars, mullers, pestles and whetstones recovered during excavations at the site and/or from surveys of the local area around it were examined. It estimates that these represent approximately one-quarter to one-third of all objects in the Rakhigarhi grinding stone collection.

The probable geologic source area was determinable for 555 of the 665 grinding stones examined, or just over 83 % of the total. In order of descending abundance, the types of stone identified are: quartzite from the Kaliana Hills in southern Haryana; water-worn cobbles of various

kinds from the Himalayan foothills region; Pab sandstone from the Sulaiman range in Pakistan; and Mathura sandstone from south-eastern Uttar Pradesh. One-hundred ten grinding stones, or around 17% of those examined, could not be confidently assigned to a known geologic formation and, therefore, were designated as "source unknown."

Nearly three-quarters of the grinding stones examined are made from stone derived from the Kaliana Hills, which are a series of small outcrops in southern Haryana around 75 km south of Rakhigarhi. The rock there is actually a variety of Delhi quartzite, which mainly occurs along an extensive zone extending from Northern Rajasthan to the city of New Delhi. However, the quartzite along that main zone is grey in colour, has a highly silicified, often glassy texture and is generally unsuitable for use as grinding stone. The Delhi quartzite found in the Kaliana area outcrops (which are outliers around 50 km west of the main Delhi quartzite formation) has a tightly packed granular texture and is still used to make querns, mullers, mortars and pestles today. Most importantly, only the Delhi quartzite at this location has the highly distinctive appearance - reddish in colour with thin red seams - that is identical to the almost 75% of the grinding stones in the Rakhigarhi collection It has recorded grinding stones made from this same material at numerous ancient sites across Haryana and Punjab including Harappa, where it comprises 20% of the overall assemblage.

Fifty-one of grinding stones (or a little under 8% of those examined) was whole or fragmentary cobbles that had undoubtedly been shaped in a dynamic fluvial environment. Some are composed of dense black basalt while most are white, grey or pink varieties of quartzite. Such heavily water- rounded cobbles are not found in the northern Aravallis. These stones were obtained, in all likelihood, from the foothills of the Himalayas, which begin roughly 175 km to the northwest of Rakhigarhi. They are quite common in the beds of the major rivers draining the Himalayas such as the Ghaggar, Beas, and Sutlej.

Although the ten grinding stones made from one the remaining two identifiable material types represent an extremely small percentage of the examined artefacts, they serve to demonstrate the long-distance connections that residents of Rakhigarhi had with regions beyond the plains of Haryana. Five of the ten are composed of tough gray-white sandstone that has a sugary textureand distinctive brown patches. This material, known as Pab sandstone, derives from the Sulaiman Range, which rises some 550 km to the west northwest ofRakhigarhi. This very same rock type makes up approximately 30% of the total grinding stone assemblage at the site of Harappa. The remaining five grinding stones are composed of fine-grained reddish sandstone with light khaki-coloured patches that is at immediately recognizable as Mathura sandstone. This stone occurs around 250 km southeast of Rakhigarhi in Uttar Pradesh and was a popular material for historic period sculpture and architecture.

One hundred and ten grinding stones (or around 16% of those examined) could not be assigned to any geologic formation and so were designated "source unknown." Keeping in mind the relative proximity of Rakhigarhi to the Gangetic Basin, it is quite likely that many of the latter types were derived from sources located on the western margins of the site.

A picture of grinding stone acquisition at Rakhigarhi is beginning to emerge. It can now be stated that site residents obtained the raw material for such tools from sources located roughly in each of the four cardinal directions. They relied heavily on stone from the south in the Kaliana Hills, which were among the nearest sources to the city (outcrops in the vicinity of Tosham are slightly closer but the igneous rocks there do not seem to have been exploited for grinding stone material). A substantially smaller portion of the grinding stones used at Rakhigarhi seem to have been derived from river-beds and/or alluvial deposits to the north of the site in the Himalayan Foothills region. Long distance

connections to the west are demonstrated by the presence of a handful of Pab sandstone querns from the Sulaiman Range while a few Mathura sandstone artefacts confirm links toward the Gangetic Basin in the east.

Although only a portion Rakhigarhi's grinding stones have been examined, some changes in raw material acquisition patterns over time seem to be evident. The two mounds from which the largest numbers of artefacts were examined are RGR-2 (n = 237) and RGR-6 (n= 228). The grinding stones examined from RGR-2 were from Harappan Period levels. RGR-6 is entirely an Early Harappan Period mound. Over 86% of the artefacts from RGR-6 are attributable to the Kaliana Hills while most of the remaining are from unknown sources. In contrast, just under 60% of the stone in the Harappan Period levels of RGR-2 came from the Kaliana Hills. Nearly 20% came from the Himalayas while the rest are Pab sandstone, Mathura sandstone or from unknown sources. So at Rakhigarhi there appears to have been a shift over time toward the acquisition of grinding stone from more diverse and distant sources. A similar (but even more pronounced) shift was detected at the site of Harappa between the Early Harappan and Harappan periods.

Important Materials not yet Studied

In addition to being large, Rakhigarhi's excavated stone and metal artefact assemblage is very diverse. It will take many more years to fully examine all of the raw material types present within it. One important type not yet studied is chert. When samples are eventually compared to the INAA database of South Asian chert sources it is highly probable that a link from Rakhigarhi to the chert quarries in the Rohri Hills of Sindh will be confirmed. Similarly, it is quite possible that copper from the northern Aravalli Range (i.e., the Khetri copper belt) and alluvial gold from rivers debauching the Himalaya foothills were probably traded *via* ancient Haryana to the Harappan consumers across the Indus system. At this writing, studies of both metals are underway (copper) or in the planning stages (gold).

Although it was initially believed that some of the vibrant blue beads recovered from Rakhigahri might be composed of sodalite, after close inspection of numerous examples in 2009 by Law, it is now thought that most or all are actually made of lapis lazuli. Even though none of these beads have yet been analysed, the likely presence ofthis stone provides important insights into the extent of the site's trade networks. Deposits of lapis lazuli have been purported to exist in Egypt, Iran, Pakistan and even parts of India. However, none of these supposed occurrences have ever been confirmed. Genuine deposits of the stone in Russia and Myanmar (Burma) were probably too distant and/or too minor to have been sources during the Harappan Period. The only viable source oflapis lazuli during ancient times would have been the famous deposits in the Badakhshan region of northern Afghanistan (Law 2011: Appendix 4.4), which lies just over 900 km northwest of Rakhigarhi.

Conclusions

The application of site catchment analysis has provided an excellent framework through which to examine of subsistence potential of the local area around Rakhigarhi. Fertile and well watered local soils were doubtlessly crucial factors in the settlement of the Sarasvati-Drishadvati valley and the eventual urbanization of the region during the Harappan Period. From the above observations it is apparent that the subsistence requirements of Rakhigarhi residents could be met within the local catchment area since the time of the site's first occupation. The economy of the pre-formative phase at the site was primarily agro-pastoral in character with a modicum of craft activity. During as the site grew during the formative stage of the Early Harappan Period, agro-pastoral satellite settlements began to emerge. Despite changes to the hydrological regime over the subsequent millennia, the local area around Rakhigarhi remained (and still remains) highly productive agriculturally.

The stone and metal acquisition networks that have been identified thus far are presented visually on (Fig. 4) (please note that the routes display are entirely conjectural). INAA of steatite artefacts indicates that residents used raw material derived from deposits in northern Pakistan. INAA of agate-carnelian nodule fragments and manufacturing debris confirms that this variety of stone was being transported to the site from sources in Gujarat. Lead isotope assays of lead and silver objects suggest that these metals were obtained from deposits in southern Baluchistan. Visual examinations of grinding stones has revealed that while multiple source areas were being exploited, the large majority of these objects are composed of rock occurring in southern Haryana. It is important to note that for each of these materials, save steatite, there are indications that other, presently unknown sources were also being exploited.

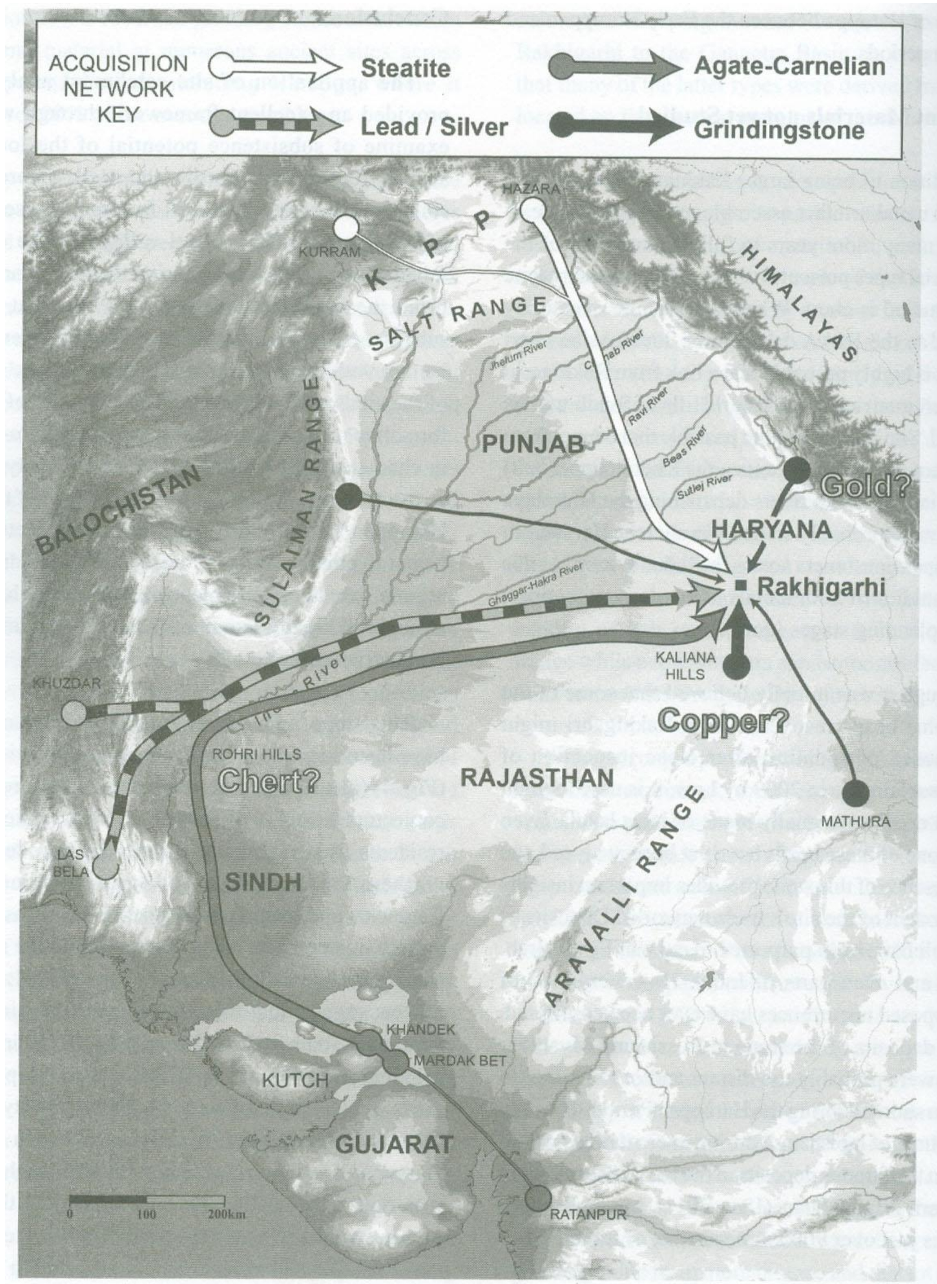


Fig. 4: Stone and metal acquisition networks of Harappan Rakhigarhi

The data generated from the analyses conducted thus far, although limited, clearly show that residents of Rakhigarhi, like that Harappans dwelling located on the Harappan were participating in extensive inter-regional stone and metal acquisition networks. These networks are

almost certain to become even more diverse as studies of the assemblage continue.

When considered together, the results of the site catchment analysis and geologic provenience studies help to create a picture Rakhigarhi's economic space that is both layered and broad. The settlement was simultaneously positioned to take full advantage of the agriculturally productive local environment and crucial raw material sources on its regional periphery. These local and regional resources in turn generated for site residents the capacity to acquire, through long-distance trade networks, essential and exotic good from other regions of the Harappan realm.

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Appendix 3

Initial geologic provenience studies of stone and metal artefacts from Rakhigarhi

Introduction

Rakhigarhi was one of largest Harappan settlements. Located in what Gregory Possehl (1992) defined as the“eastern domain” of theIndus Civilization, the ancient city could reasonably be consideredthe “provincial capital” of that domain. The site was surrounded by network of subsidiary settlements in adensely populated zone that providedits residents with ample agricultural surplus, forest products, and other resources from the local alluvial plain (Garge 2011). However, there are no rock or mineral resources whatsoever within 50 km of Rakhigarhi. Excavations there haverevealed, among other things, a broad range of stone and metal artefacts made from raw materials that had to have come from sources outside of this local zone. The study of these objects allows us to reconstruct non-local resource acquisition patterns at Rakhigarhi and, by doing so, examine its residents' connections with other “domains” and/or resources areas across the Harappan realm and beyond.

In the absence of historical accounts of trade, *geologic provenience studies* can provide compelling evidence that an exchange network once existed between the ancient inhabitants of a region where a stone or metal artefact entered the archaeological record and those in the region where the raw material the artefact is composed of originated. The soundest provenience determinations are ones based on analyses of artefacts composed of unadulterated rock or mineral rather than processed metal, which could contain metal from multiple sources as well as various alloys and additives. With unadulterated stone, “specific types of raw materials can be related to an objective geologic reality that is derived from natural (as opposed to cultural) processes” (Odess 1998: 419).There have been several major broad-scale studies (Fentress 1976; Lahiri 1992; Ratnagar 2004) of Harappan trade networks that examined multiple varieties of stone and metal to construct models of proto-historic resource access and exchange. Randall Law (2011) built upon these earlier studies by, using a variety of analytical methods, conducting large-scale direct comparisons of artefacts from Harappan sites to

samples collected from potential stone and metal sources throughout the greater Indus region. In 2007, he was invited by the Rakhigarhi's excavator, Dr. AmarendraNath, to begin geologic provenience studies of that site's stone and metal artefact assemblage[1].The report herein is a summary of the progress and preliminary findings of the geologic provenience analyses undertaken to date for this project.

Rakhigarhi and its local physiographic environment

The site of Rakhigarhiwas excavated for three seasons – 1997-98 (Nath 1998), 1998-99 (Nath 1999) and 1999-2000 (Nath 2001). Multiple mounds were identified and numbered as RGR 1 through RGR 7. Of these, RGR 1, RGR 2 and RGR 6 were revealed to have, in addition to Harappan Period occupation, a formative stage followed by anEarly Harappan settlement stage. RGR 7 is a necropolis.

The settlement lies on the flood plain of Sarasvati-Drishadvati basin. The most up-to-date picture of the local physiographic environment around Rakhigarhi was compiled by TejasGarge (2011). In the past, the Drishadvati (or Chautang) River flowed through the modern districts of Karnal, Jind and Hissar before meeting the Sarasvati near Suratgarh in Rajasthan. Topographically, this area is a, monotonous upland terrain that is part of the alluvial of Satluj-Yamuna plain;the western portion of which gradually transitions into the Thar Desert. Prominent features are aeolian sand deposits of variable shapes and thicknesses overlying the Pleistocene alluvium. The patches of older alluvium are either exposed or

[1]In a letter (F. No. 09/09/05 - RGR) dated 30 April 2007, Dr. AmarendraNath (Director, Archaeological Survey of India, retired) informed Randall Law that then Director-General of the ASI, Ms. AnshuVaish, had given permission to Dr. Law to carry out a detailed study of the stone and metal artefacts recovered during excavations at the Indus Civilization city of Rakhigarhi, District Hissar, Haryana. The preliminary examination of artefacts housed in the Rakhigarhi section of PuranaQila, New Delhi took place over one week in late June of 2008. During this brief period, multiple types of stone and metal objects were studied and photographed. All data (on excel spreadsheets) and photographs generated were placed on the section's main computer and a back-up on DVD was made for the Rakhigarhi archives. Select lead and silver artefacts were briefly washed in a solution of ultra-pure water and 0.05% EDTA. The solution was retained for lead isotope analysis. A small set of non-diagnostic raw material debris fragments was set aside for further, more detailed characterization and/or geologic provenience studies. In October of 2008, Dr. R.S. Fonia (then the Director of Exploration and Excavation, ASI) brought this small set of samples to the University of Wisconsin-Madison, USA for analysis.

occur at shallow depth beneath a veneer of sand in *tals* or topographic



Figure 1: Steatite sources of the Greater Indus region and Harappan steatite trade networks.



Figure 2: Fragments of khaki-colored steatite debris from [**A**] Rakhigarhi (RGR 573.B) and [**B**] Harappa.

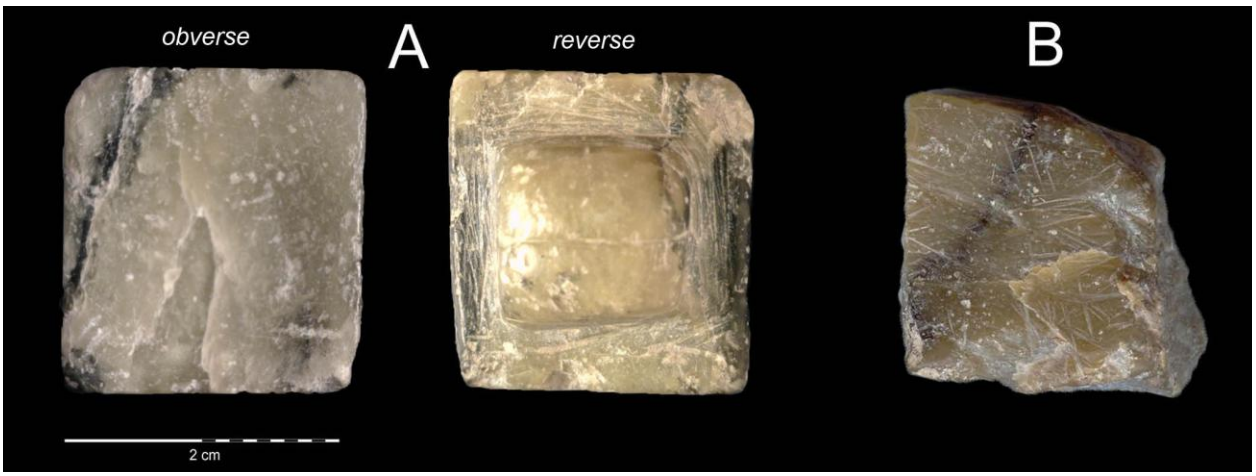


Figure 3: [**A**] An unfinished stamp seal (RGR 1731) from Rakhigarhi carved from an olive-green and black-banded steatite. [**B**] A debris fragment of the same material from Harappa.

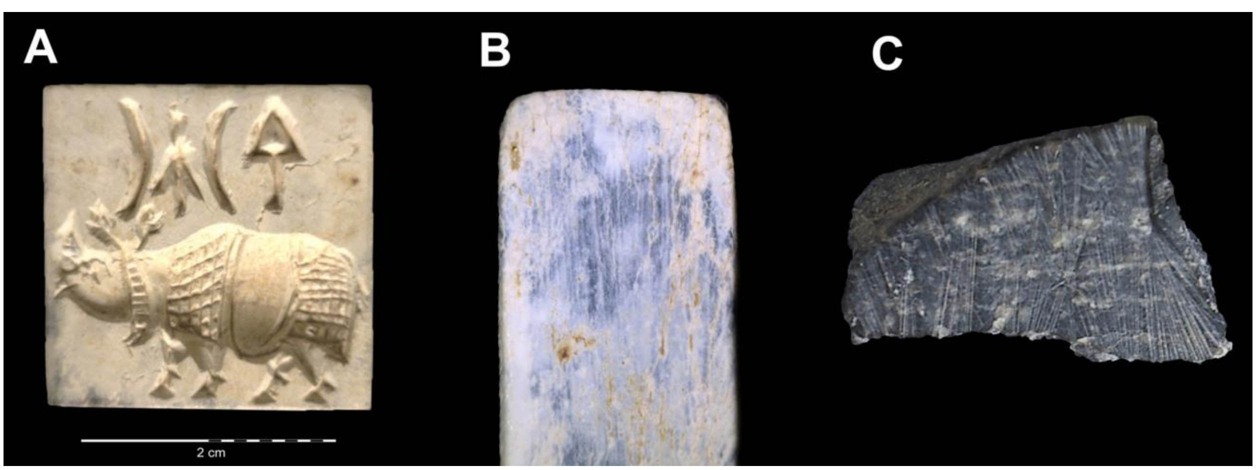


Figure 4: [**A**] SealRGR 7230 from Rakhigarhi.[**B**] The side of the seal where the surface has partially worn away revealing the black steatite beneath. [**C**] A sawn black steatite debris fragment from Harappa.

depressions enclosed by fossilized dunes known as *tibbas*. Silted-up river channels with continuous or intermittent levee undulationsoccupy a relatively lower position. The general gradient of the terrain is from north-east to south-west and then west.

In terms of this study it is important to note that the bedrock of this area is deeply buried and is wholly concealed under alluvial and aeolian deposits. There are no accessible sources of stone or metal whatsoever available anywhere within the local area. The nearest outcrops of rock are located in southern Haryana approximately 50 km (Tosham area) to 75 km (Kaliana Hills) south of Rakhigarhi. The main part of the Aravalli Range beings some 125 km to the south while the foothills of the Himalayas begin to rise around 175 km to the northeast. Therefore, all stone or metal object recovered during excavations at Rakhigarhi – from the tiniest bead to the largest grindingstone – was made of raw material that had to have been imported to the site from one of these sources or even more distant ones.

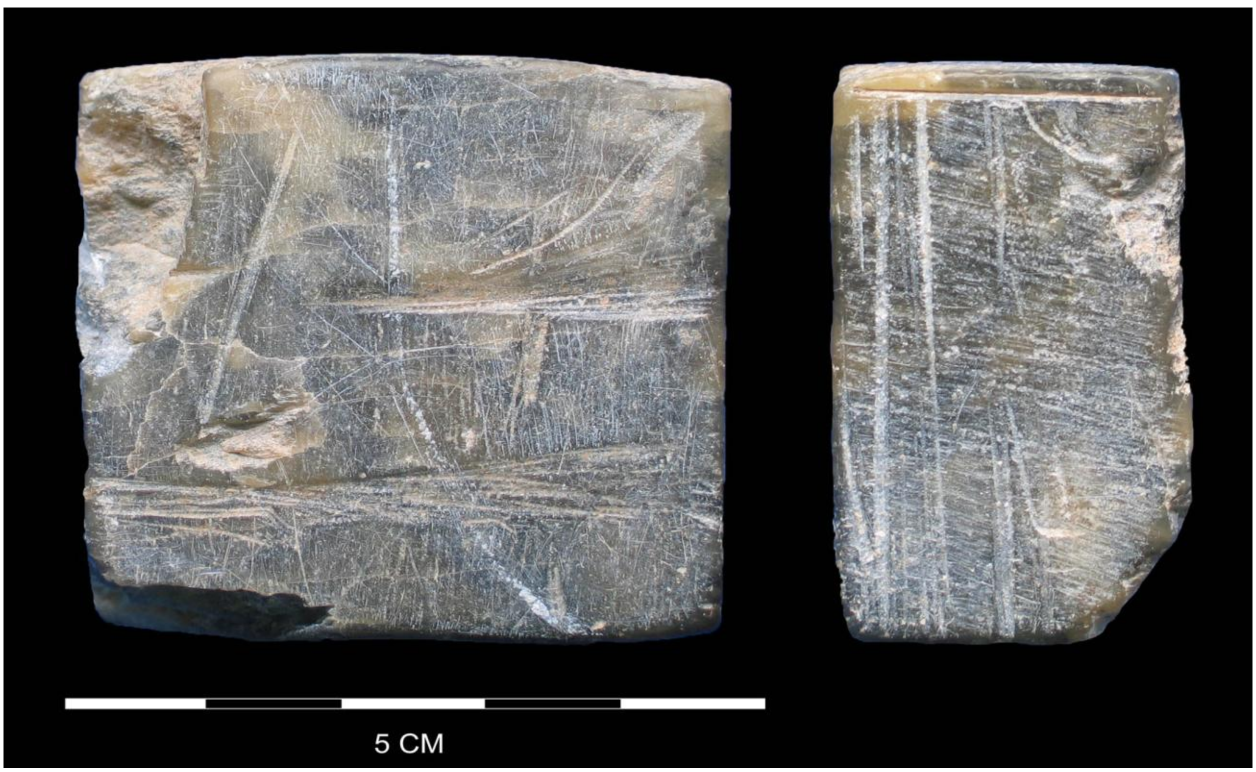


Figure 5: Seal blank or roughout, artifact #3607.

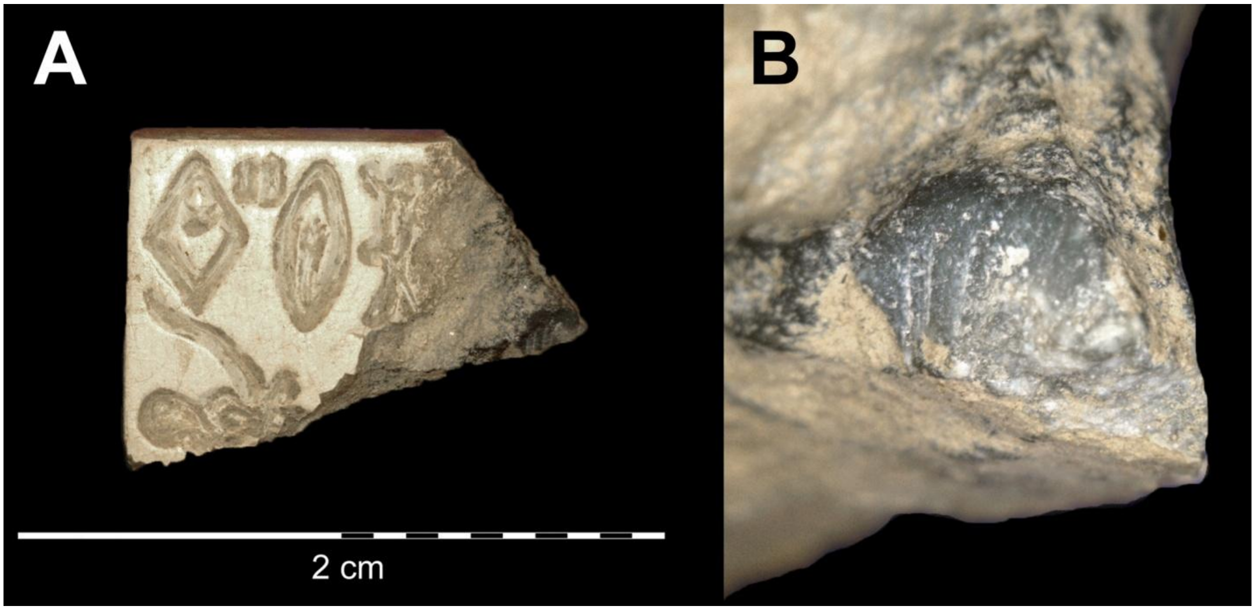


Figure 6: [**A**] Unicorn seal fragment#6304. [**B**] Detail of the grayish-green steatite of the seal's interior.

Observations, analyses and results

Steatite artefacts

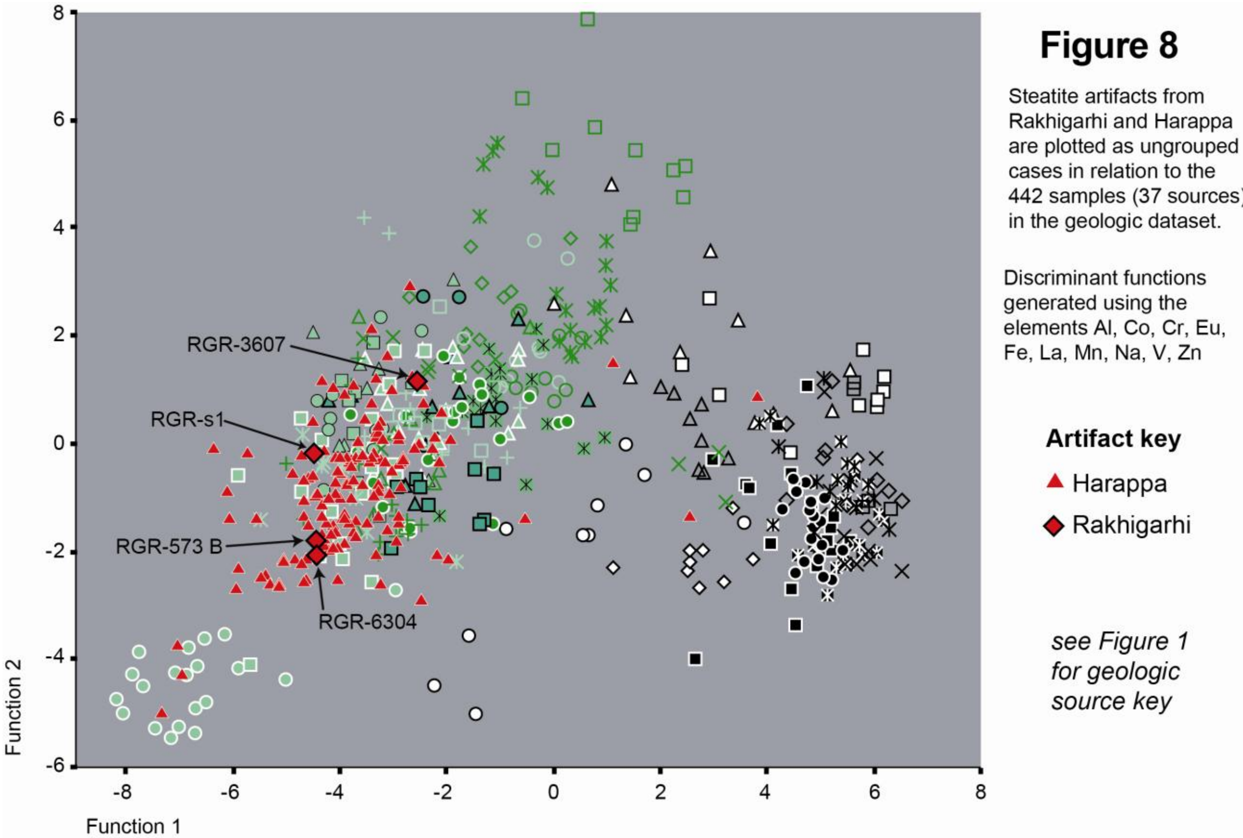
Steatite –a rock composed mainly of the mineral talc – was one of the most important types of stone in the Harappan corpus of raw materials. It was used to create common items, such as disc beads, as well as important objects like stamp seals and inscribed tablets. Although steatite occurrences are found in many parts of South Asia (Law 2002), geologic provenience analyses of artefacts from sites across the Indus Civilization (Law 2011: Chapter 7) indicate that Harappans mainly acquired this type of stone from sources located in what today is northern Pakistan, primarily those in the Hazara District (Figure 1). Deposits in some other areas, such as northern Rajasthan, were also exploited but to a much more limited degree. Steatite objects from Rakhigarhi were examined and/or analyzed in an attempt to determine what sources residents at that site utilized.

Raw steatite exhibits a wide range of colors and patterns. However, the vast majority of objects made from this stone at Rakhigarhi and other Indus Civilization sites appear solid white due to having been heated at high temperatures and/or covered with an applied white surface. At sites

Figure 7: INAA data for four steatite artifacts from Rakhigarhi. Data listed in parts per million (ppm).											
	Al	**Co**	**Cr**	**Eu**	**Fe**	**La**	**Mn**	**Na**	**Sc**	**V**	**Zn**
RGR 573.B	2090	0.842	0.565	0.0308	2810	0.010	2.160	320.0	0.008	1.480	10.90
RGR-s1	1798	0.786	1.683	0.0447	2224	0.643	14.93	302.3	0.069	3.459	24.88
RGR 6304	1657	0.631	2.054	0.6621	2886	0.179	5.227	233.8	0.074	1.326	20.01
RGR 3607	1844	1.357	2.616	2.0980	1406	0.436	11.86	364.2	0.123	4.627	27.36

like Harappa and Mohenjo-Daro, thousands of raw steatite debris fragments and unfinished steatite objects have also been recovered. In contrast, only a handful of such artefacts were observed among the Rakhigarhi materials. Perhaps more will come to light as studies of the collection continue. The examples examined are composed of types of raw steatite that are identical in appearance to types documented by Randall Law at Harappa (see Law 2011: Figure 7.4). Below are three examples. Figure 2 compares two fragments – one from Rakhigarhi [A] and one from Harappa [B] – of khaki-colored steatite. In Figure 3, an unfinished stamp seal from Rakhigarhi [A] carved from an olive-green and black-banded type of steatite is compared to a large debris fragment from Harappa [B] composed of identical looking stone. Figure 4 shows stamp seal RGR 7230 [A] and a detail of its side [B] where the surface has partially worn away to reveal the black steatite from which the object was carved. A sawn piece of black steatite manufacturing debris from Harappa [C] is shown for comparison.

Visual examinations, while informative, are generally not sufficient for identifying the geologic sources of steatite artefacts (the reason being that identical macroscopic types of stone can and often do occur at different steatite deposits). That task is best undertaken using instrumental neutron activation analysis (INAA). This highly accurate and precise method for quantifying the major, minor and trace element compositions of materials has been employed by researchers around the world in efforts to identify the geologic sources of a wide range of archaeological stone. In brief, INAA involves the irradiation (or activation) of elements within materials by exposing them to a neutron flux. Following varying periods of decay, the gamma ray emissions they produce are detected and counted. After the results are screened of elements that failed to be detected in all samples or had high count-rate standard deviations, the data are evaluated using canonical discriminant analysis (CDA). During



CDA, linear combinations of variables called *discriminant functions* are generated that produce a maximum degree of separation (discrimination) between various defined groups of cases, which in this study are the individual sets of samples that Law personally collected from different geologic sources in India and Pakistan. Artefacts are plotted as ungrouped cases and assigned to the group (geologic deposit) whose center (or centroid) in multidimensional space they are nearest.

Steatite samples from four artefacts were subjected to INAA. Two of the four were pieces of manufacturing debris, one of which (RGR 573.B) is pictured in Figure 2 A. The other (not pictured) was a 4mm sliver of brown steatite from a bag of unnumbered surface materials. We designated this fragment RGR-s1. A third sample was taken from a battered block of steatite (RGR 3607) that, in all probability, was a blank or roughout for a stamp seal (Figure 5). Loose material from a damaged area of the block was collected for analysis. The final artifact sampled (RGR 6304) was a fragment of a unicorn stamp seal (Figure 6 A). A small amount of the grayish-green steatite exposed in its broken section (Figure 6 B) was carefully removed for analysis. All of the artefacts are from the mound at Rakhigarhi designated RGR-2. The two debris

fragments are surface finds while the seal blank and seal fragment are from Mature Harappan levels.

Preparation of the Rakhigarhisteatite samples for INAA took place at the Laboratory for Archaeological Chemistry, Department of Anthropology, University of Wisconsin-Madison. Analysis was conducted at the University of Wisconsin's Nuclear Reactor (UWNR) research facility by the team supervised by lab director Robert Agasie.The elemental datagenerated for the four artifact samples, which are listed in Figure 7, were compared using CDA to a databaseof geologic samples collected from 37 steatite sources across Indiaand Pakistan (Law 2011: Appendix 7.3). Those sources are identified by deposit and region on Figure 1 of this report. Figure 8 shows the 442 geologic samples from the 37 sources plottedusing the first and second discriminant functionsgenerated by CDA. For reference, the 141 steatite artefacts from Harappa that have been analyzed to date are plotted (using red triangle symbols on the figure) as ungrouped cases in relation to the sources. The four artefacts analyzed from Rakhigarhi are similarly plotted (using red diamond symbols) above the Harappa samples. The predicted group (source) membership for three of the artefacts (RGR-s1, RGR-6304 and RGR 3607)was one of the steatite deposits located in the Hazara District, *Khyber Pakhtunkhwa* Province or KPP (formerly known as the North-West Frontier Province or NWFP), Pakistan. The fourth artifact (RGR 573.B)was assigned membership among a group of geologic samples from the Daradar steatite deposit in the Safed Koh Range of the Kurram Agency, Federally Administered Tribal Areas (FATA), Pakistan.

Although only four steatite artefacts from Rakhigarhi were analyzed, the results strongly suggest that residents of the site were part of the same extensive acquisition/distribution network for this raw material as their fellow Harappans at other Indus Civilization cities. Stone from sources in northern Pakistan makes up 95% of such artefacts analyzed from Harappa and approximately two-thirds of those tested from Mohenjo-Daro and Dholavira. The percentage from Rakhigarhi presently stands at 100% but that is almost certain to change when a larger sample from the site is tested. Steatite from sources in the Alwar and Jhunjhunu districts of northern Rajasthan has been identified at Harappa and Mohenjo-Daro (Law 2011) as well as at Mitathal in south Haryana (Prabhakar et al 2010). Given Rakhigarhi's relative proximity to that

region, it is highly probable that stone from deposits there will eventually be detected in its assemblage.

At this point it is not possible say how steatite from northern Pakistan came to Rakhigarhi in Haryana. The paths of the trade routes drawn on Figure 1, including the highlighted one extending from Harappa to Rakhigarhi, are entirely conjectural. However, given Harappa's geographic position in relation to the northern Pakistan deposits and the fact that some 95% of the steatite at the site seems to have been derived from sources in that region, it is not unreasonable to speculate that the city might have been the center where this stone was first gathered and then distributed to consumers across the Indus Civilization. Thus, we have drawn the trade routes to reflect this possibility. One may ask, why would residents of Rakhigarhi and other Indus sites use steatite from northern Pakistan when there were other, often closer, sources available? The reason is that stone from deposits in the north, especially those in the Hazara District, possessed physical qualities that Harappans sought (i.e., it becomes pure white when heat-treated).

Agate-carnelian artefacts

Ornaments (mostly beads) made from the translucent reddish-orange variety of agate known as *carnelian* are almost as ubiquitous at Harappan settlements as steatite objects. Geologic provenience studies of carnelian artefacts from a half dozen sites across the Indus Civilization (Law 2011: Chapter 8) appear to confirm what researchers have long suspected – i.e., that this variety of stone was mainly derived from deposits located in the Gujarat region. It seems, however, that the agate deposits Harappans primarily exploited occur in northern Gujarat rather than, as was widely assumed, the more famous source at Ratanpur in the southeastern part of that state. Agate-carnelian artefacts from Rakhigarhi were examined in order to determine if the same acquisition pattern would be evident at that site, which of all Indus cities was the most far removed from the Gujarat sources.

Due to time limitations, only cursory visual examinations of finished agate-carnelian ornaments were conducted. Randall Law's overall impression was that carnelian beads at Rakhigarhi are basically identical to other such artefacts at Harappan sites, both in terms of their styles

and the material from which they were made (that is to say, Gujarati

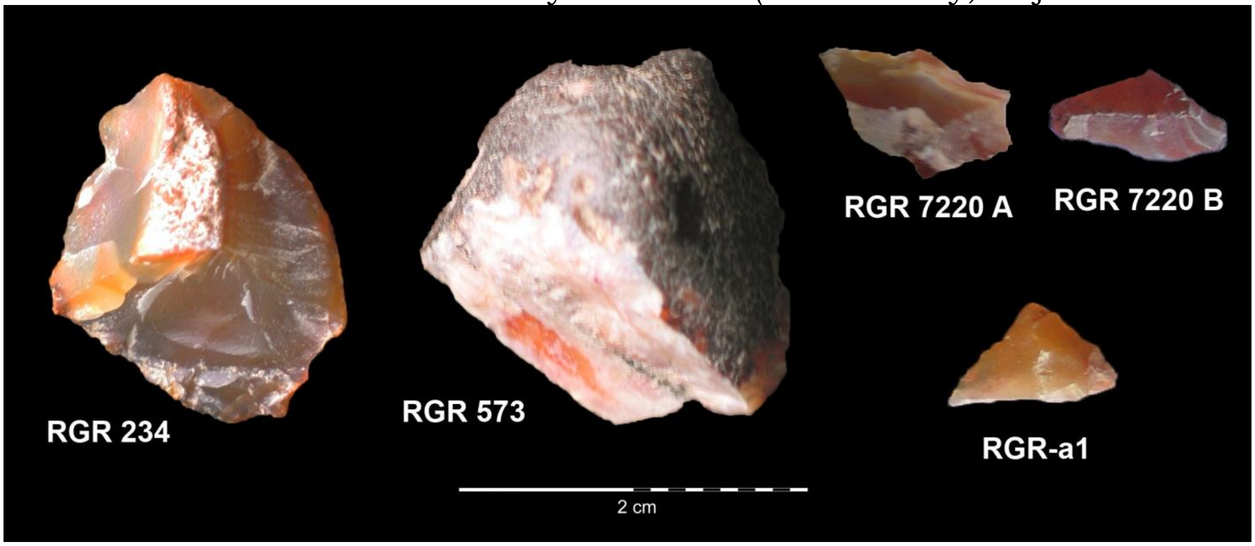


Figure 9: Agate-carnelian nodule fragments and flakes from Rakhigarhi

Figure 10: INAA data for six carnelian artifacts from Rakhigarhi. Data listed in parts per million (ppm).

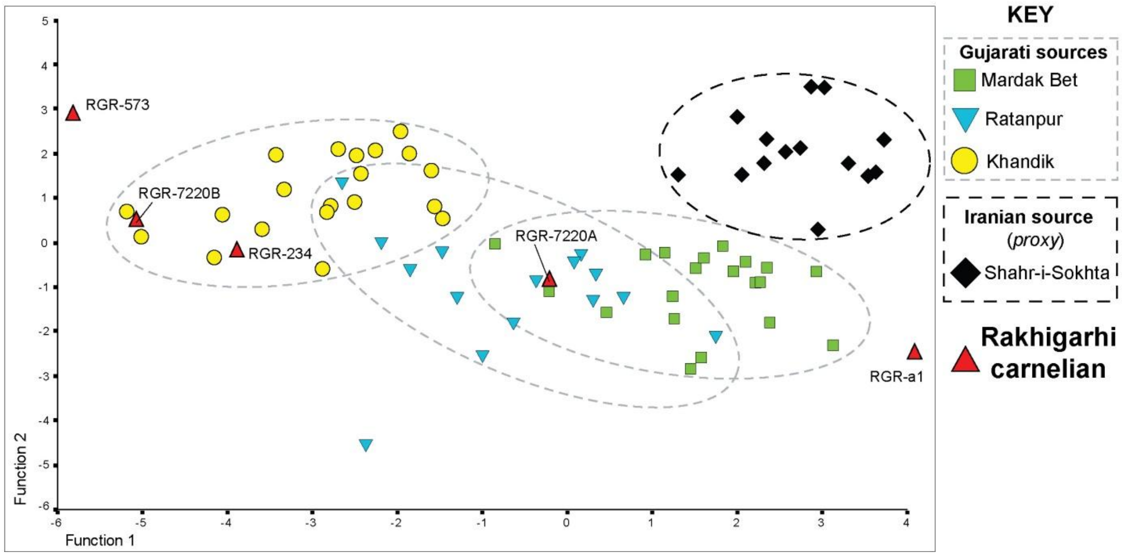
	Al	Co	Cr	Eu	Fe	La	Na	Sb	Sc	V
RGR 234	1485	0.290	0.597	0.0470	644.2	0.0254	83.49	0.0819	0.004	1.228
RGR 573	1557	0.837	0.783	0.0461	571.4	0.4638	69.60	0.3380	0.036	1.153
RGR 7220 A	1807	0.055	0.322	0.0226	443.0	0.0408	136.10	0.4227	0.023	1.581
RGR 7220 B	1626	0.532	0.404	0.0662	1060.0	0.0560	63.98	0.3177	0.051	1.014
RGR-a1	1642	0.068	2.915	0.0270	659.5	0.5868	257.70	0.0555	0.571	1.641

carnelian). However, he observed a number of examples made from carnelian exhibiting a hue and/or patterning that is somewhat unlike that he encountered during his explorations of sources in Gujarat. While this does not rule out Gujarat as the source area for those particular artefacts, it does open the possibility that raw material from occurrences in alternate regions was sometimes exploited. It is clear though that agate-carnelian ornaments were being manufactured at Rakhigarhi. Artefacts representing all stages of bead production were observed in the collection. Among these materials are nodule fragments, which indicate that at least some carnelian was transported to the site in raw, unmodified form.

Five carnelian artefacts (nodule fragments and non-diagnostic beadmaking debris), all of which were recovered from the surface or near

Figure 11: CDA comparison of Rakhigarhi carnelian artifacts to Gujarati and Iranian agate sources

Discriminant Functions generated using the elements Al, Co, Cr, Eu, Fe, La, Na, Sb, Sc, and V



surface levels on mound RGR-2, were selected for INAA (Figure 9). Using CDA, the elemental datagenerated (Figure 10) were compared to a database of geologic samples from three agate sources in Gujarat and one in eastern Iran (Figure 11). The Gujarat sources include the deposit at Khandek in eastern Kachchh (some 70 km from the Harappan city of Dholavira), the extensive agate beds on Mardak Bet in the Little Rann of Kachchh (105 km from Dholavira), and the famous agate mines of Ratanpur (390 km from Dholavira). The source in Iran is represented by proxy using carnelian nodule fragments recovered from the proto-historic site of Shahr-i-Sokhta. All five of the Rakhigarhi artefacts were assigned to one of the Gujarat sources – three to the Khandek deposit (RGR 234, RGR 572 and RGR 7220 B), one to the Mardak Bet deposit (RGR-a1) and one to the Ratanpur mines (RGR 7220 A). Although they represent an extremely small sample of agate-carnelian bead production debris at the city, the five provenience assignments do correspond to the general acquisition pattern for this raw material detected at multiple Harappan sites (Figure 12), which is – most of the carnelian utilized came from sources in northern Gujarat while only minor amounts originated in the more famous (but more distant) mines of Ratanpur. These results should be treated cautiously, however, as there are many agate-carnelian sources in the Greater Indus region and beyond that remain to be characterized (some of these are identified on Figure 12). Note that in Figure 11 two samples – RGR 573 and RGR-a1 – plot somewhat away



Figure 12: Greater Indus Valley region agate occurrences and carnelian aquisition networks.

from the datapoints representing the deposits to which they were

assigned (Khandek and Mardak Bet respectively). It is possible that those particular artefacts were derived from a source(s) not represented in the geologic database.

Lead and silver artefacts

Lead objects and silver ornaments, while generally not abundant at Harappan settlements, have been recovered at numerous sites across the Indus Civilization. Occurrences of lead, many of which are viably *argentiferous* (meaning that they contain an extractable quantity of the precious metal silver), are found in numerous parts of the Greater Indus Valley region as well as areas outside of it with which Harappans are known to have had long-distance contacts. Archaeologists have long employed lead (Pb) isotope analysis in efforts to identify the geologic sources of artefacts composed of or containing that metal. Using this method, a large-scale provenience study was initiated in 2002 and has now grown to include samples from over three-dozen geologic sources and artefacts from eight Harappan sites (Law and Burton 2006; Law and Burton 2008; Law 2011: Chapter 12). Those sources and sites are identified on Figure 13. Although this study remains ongoing, a picture of lead and silver acquisition networks during the Harappan Period (identified using lines and arrows on Figure 13) is beginning to emerge. It appears that peoples across the Indus Civilization primarily acquired these metals from deposits in southern Balochistan. However, residents of Harappa and Dholavira also utilized lead and/or silver nearer sources (deposits in Jammu and Kashmir, and northern Gujarat respectively). Five artefacts from the Rakhigarhi collection were isotopically assayed in order to determine if a similar acquisition pattern existed there. The ancient city lies approximately 950 km from the southern Balochistan source area but there are rich lead and lead-silver deposits some 200 to 400 km north of the site in the Himalayas.

The first object sampled was a plano-convex (or bun-shaped) lead ingot (Figure 14 A& B) inscribed with Harappan characters on both sides (Figure 14 C & D). A small prism-shaped piece of lead (Figure 15) was also assayed. The remaining three artefacts sampled were silver ornaments – two hoops and a small disc (Figure 16). All of the objects



Figure 13: Isotopically assayed lead ore and lead-silver ore deposits of the Greater Indus region, archaeological sites from which lead or silver artifacts have been analyzed, and Harappan lead and/or silver acquisition networks

were recovered from excavations on mound RGR-2, save the prism-

shaped piece of lead, which was from mound RGR-4.

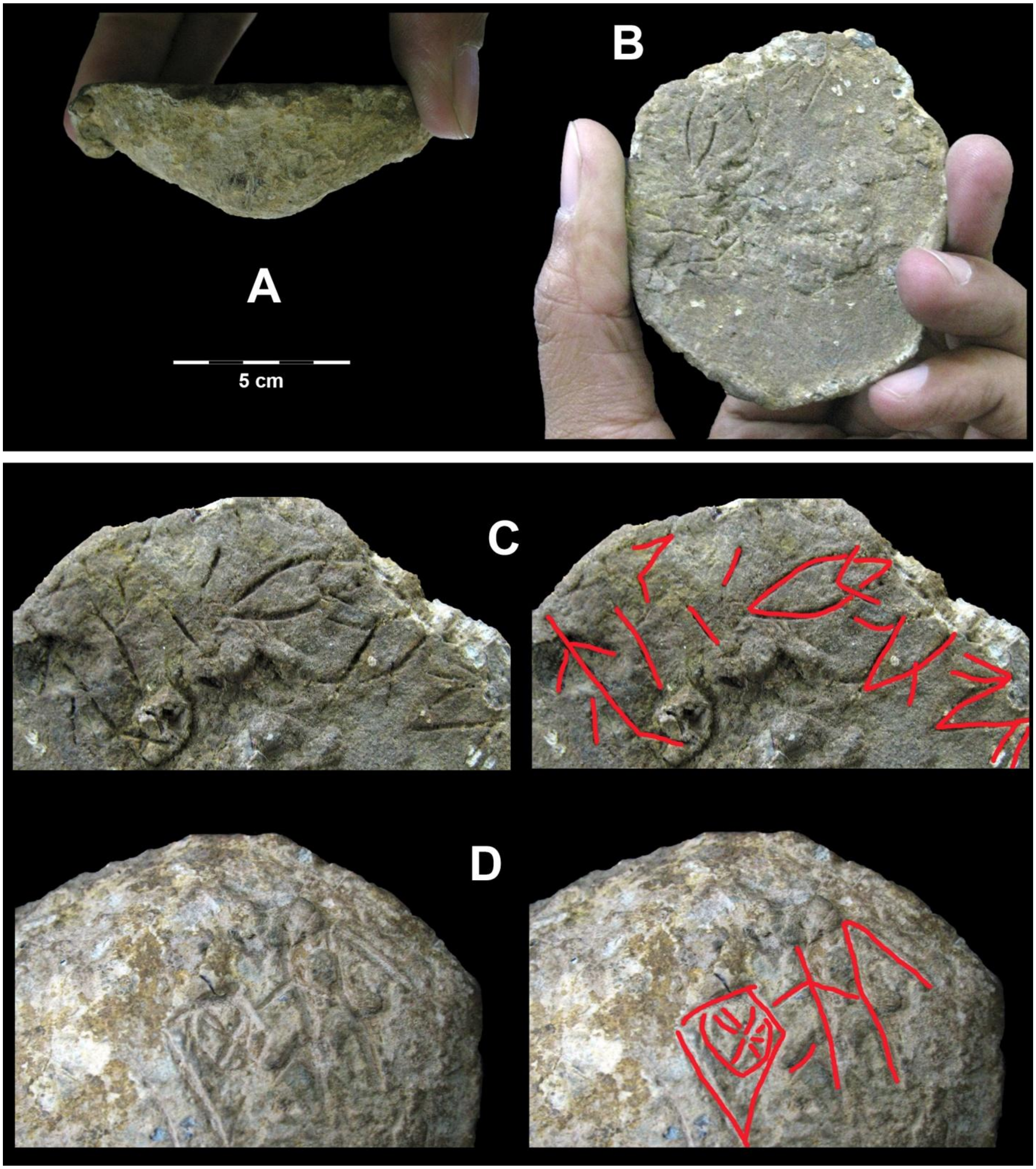


Figure 14: Side [**A**] and top [**B**] views of a lead ingot inscribed with Harappan characters. Detail images of the top [**C**] and bottom [**D**] inscriptions.



Figure 15: Lead piece, RGR 424

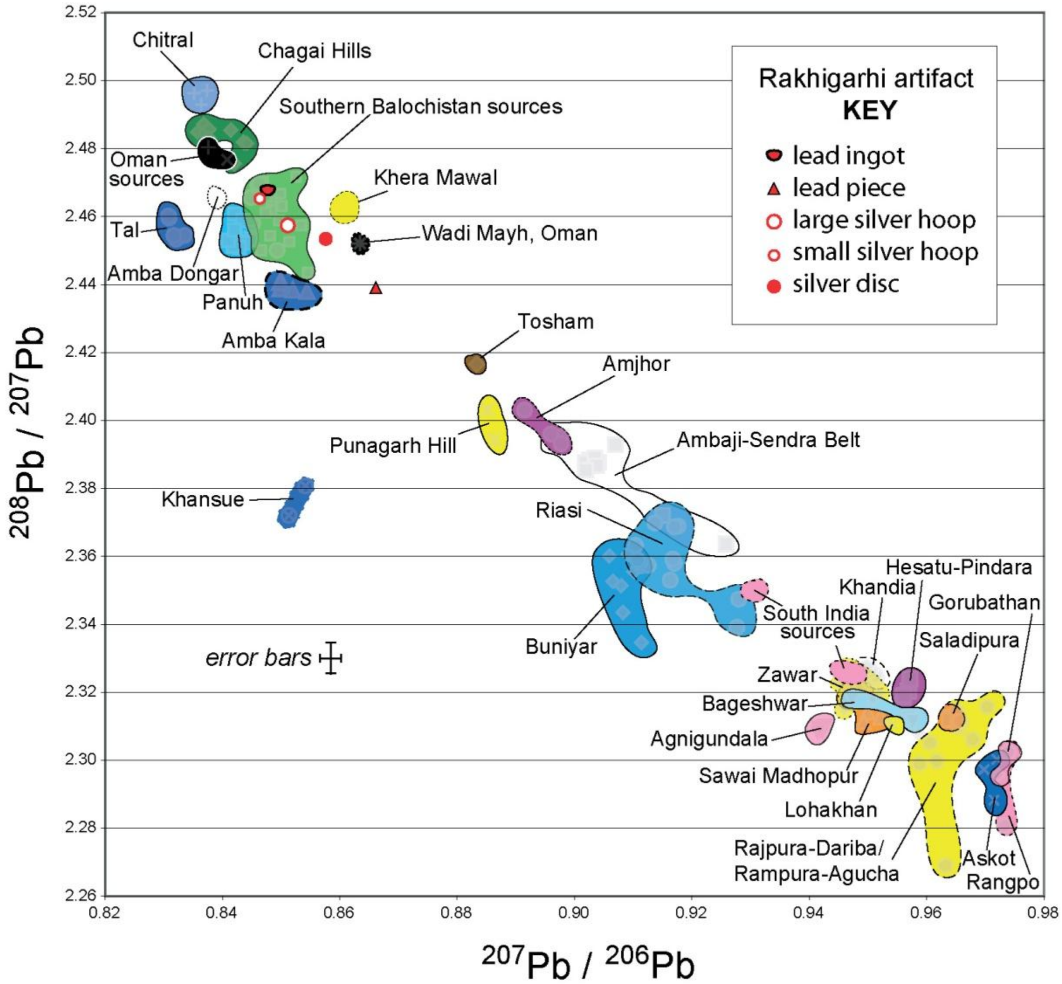


Figure 16: Three silver ornaments

Figure 17: Pb isotope data for two lead and three silver artifacts from Rakhigarhi

Artifact	Pb^{208} / Pb^{207}	Pb^{207} / Pb^{206}	Pb^{207} / Pb^{204}
inscribed lead ingot	2.4677	0.84747	15.682
RGR-424, lead lump	2.4393	0.86481	15.667
RGR-4386, smaller silver hoop	2.4666	0.84675	15.679
RGR-4098, larger silver hoop	2.4574	0.85137	15.650
RGR-3949, silver disc	2.4539	0.85594	15.676

Figure 18: Lead and silver artifacts from Rakhigarhi compared to South Asian lead and lead-silver sources



In order to extract lead from the artefacts for isotopic analysis, a solution was prepared that consisted of ultrapure water and 0.05% dissolved EDTA, which is a hexadentate chelating agent that forms coordinate bonds with lead atoms. Each artifact was immersed in the solution for five minutes, which is usually sufficient to extract lead atoms in concentrations from 100 ppb to as much as 100 ppm – orders of magnitude more than required for isotopic analysis. At that point, the lead-enriched solutions were poured into sample vials for return to Madison. The artefacts were rinsed in ultrapure water, allowed to dry, and then returned to their place of storage. The brief immersion time in the sampling solution did not result in any macroscopic alteration whatsoever of the artefacts.

Once the artifact sample solutions were back in Madison, they were prepared and then sent on to the Keck Isotope Laboratory at the

University of California-Santa Cruz where they were analyzed by Dr. Emily Peterman on a Thermo Scientific NEPTUNE multiple-collector inductively-coupled-plasma magnetic-sector mass-spectrometer (MC-ICP-MS). The results, which are listed in Figure 17, were compared to the database of Pb isotope values for South Asian lead and lead-silver ore deposits. In Figure 18, the values for the five artefacts are plotted in relation to select ore fields using the ratios $^{208}Pb/^{207}Pb$ (y axis) and $^{207}Pb/^{206}Pb$ (x axis). Three of the artefacts – the inscribed lead ingot and both silver hoops – plot squarely within the lead isotope field defined by geologic samples from the southern Balochistan sources. The silver disc and the prism-shaped lead piece fall somewhat away from that field in a part of the plot that is not, at present, represented by a lead source. These two artefacts could either be made of metal derived from a deposit (or deposits) not in the database or composed of metal from two or more sources. The latter possibility might have given the objects isotopic characteristics that cause them to plot along a "mixing line" between a southern Balochistan deposit and an unknown source (s).

Grindingstones

Most of our time with the Rakhigarhi collection was spent examining querns, mortars, mullers, pestles and whetstones, which we will collectively refer to here as *grindingstones*. These constitute an especially important and informative category of stone artifact.Grindingstoneswere essential utilitariantools that would have been used daily for processing foods as well as for performing numerous kinds of craft activities. Moreover, they were among the bulkiest (that is to say, heaviest and largest) stone objects acquired by Harappans. Providing a steady supply of grindingstones to the urban population dwelling at Rakhigarhi, where there are no local stone resources whatsoever, would have necessarily required a significant expenditure of time and energy.

Law had previously conducted a study at the site of Harappa in which the entire assemblage of grindingstones was compared to samples collected from potential geologic sources in and around the upper Indus Basin (Law 2011: Chapter 5). The general source area for around 70% of the artefacts was determinable based on an assortment of qualitative physical criteria including rock sub-variety, color, texture, grain size, patterning, visible inclusions, degree of silicification and toughness. An identical study was initiated for the Rakhigarhi grindingstones. In total,

Figure 19: A rough spatial breakdown of the 665 grindingstones examined		
location	**number of objects**	**percentage of total examined**
Mound RGR-1	18	2.71%
Mound RGR-2	237	35.64%
Mound RGR-4	80	12.03%
Mound RGR-5	5	0.75%
Mound RGR-6	228	34.29%
RGR-mound not specified	83	12.48%
Other local mounds	14	2.11%
total	665	100%

we were able to examine 665 examples of querns, mortars, mullers, pestles and whetstones recovered during excavations at the site and/or from surveys of the local area around it. A rough spatial breakdown (by mound) of where the artefacts came from is provided in Figure 19. We estimate that together they represent approximately one-quarter to one-third of all objects in the Rakhigarhi grindingstone collection.

Figure 20: The geologic source areas of the 665 grindingstones examined		
source (material)	**number of objects**	**percentage of total examined**
Kaliana Hills, Haryana (Delhi quartzite)	494	74.29%
Himalaya foothills (basalt and quartzite cobbles)	51	7.67%
Sulaiman Range, Pakistan (Pab sandstone)	5	0.75%
Uttar Pradesh (Mathura sandstone)	5	0.75%
Source unknown (various)	110	16.54%
total	665	100%

The geologic source area was determinable for 555 of the 665 grindingstones examined, or just over 83% of the total (Figure 20). In descending order, the types of stone identified are: quartzite from the Kaliana Hills in southern Haryana; water-worn cobbles of various kinds from the Himalayan foothills region; Pab sandstone from the Sulaiman range in Pakistan; and Mathura sandstone from southeastern Uttar Pradesh. One-hundred ten grindingstones, or around 17% of those examined, could not be confidently assigned to a known geologic formation and, therefore, were designated as "source unknown."



Figure 21: Delhi Quartzite outcrop near Kaliana, Bhiwani District, Haryana

Nearly three-quarters of the grindingstones examined are made from stone derived from the Kaliana Hills, which are a series of small outcrops (Figure 21) in southern Haryana around 75 km south of Rakhigarhi. The rock there is actually a variety of Delhi quartzite, which mainly occurs along an extensive zone extending from Northern Rajasthan to the city of New Delhi. However, the quartzite along that main zone is gray in colour, has a highly silicified, often glassy texture and is generally unsuitable for use as grindingstone. The Delhi quartzite found in the Kaliana area outcrops (which are outliers around 50 km west of the main Delhi quartzite formation) has a tightly packed granular texture and is still used to make querns, mullers, mortars and pestles today. Most importantly, only the Delhi quartzite at this location has the highly distinctive appearance – reddish in colour with thin red seams (Figure 22) – that is identical to the almost 75% of the grindingstones in the Rakhigarhi collection (see Figure 23 for an example). Both Law and Garge have observed grindingstones made from this same material at numerous ancient sites across Haryana and the Punjab including Harappa, where it comprises 20% of the overall assemblage.



Figure 22: Detail of Delhi quartzite in the Kaliana Hills

Fifty-one of the grindingstones (or a little under 8% of those examined) were whole or fragmentary cobbles that had undoubtedly been shaped in a dynamic fluvial environment. Some are composed of dense black basalt (Figure 24 *left image*) while most are white, gray or pink varieties of quartzite (Figure 24 *right three examples*). Such heavily water-rounded cobbles are not found in the northern Aravallis. These stoneswere obtained, in all likelihood, from the foothills of the Himalayas, which begin roughly175 km to the northwest of Rakhigarhi. They are quite common in the beds of the major rivers draining the Himalayas such as the Ghaggar (Figure25), Beas, and Sutlej.



Figure 23: A grindingstone from Rakhigarhi composed of Kaliana Hills variety Delhi quartzite

Although the ten grindingstones made from one the remaining two identifiable material types represent an extremely small percentage of the examined artefacts, they serve to demonstrate the long-distance connections that residents of Rakhigarhi had with regions far beyond the plains of Haryana. Five of the ten are composed of a tough gray-white sandstone that has a sugary texture and distinctive brown patches (Figure 26). This material, known as Pab sandstone, derives from the Sulaiman Range (Figure 27), which rises some 550 km to the west-northwest of Rakhigarhi. This very same rock type makes up approximately 30% of the total grindingstone assemblage at the site of Harappa. The remaining five grindingstones are composed of fine-grained reddish sandstone with light khaki-colored patches (Figure 28 A) that is at immediately recognizable as Mathura sandstone. This stone occurs around 250 km southeast of Rakhigarhi in Uttar Pradesh and was a popular material for historic period sculpture (Figure 28 B) and architecture.

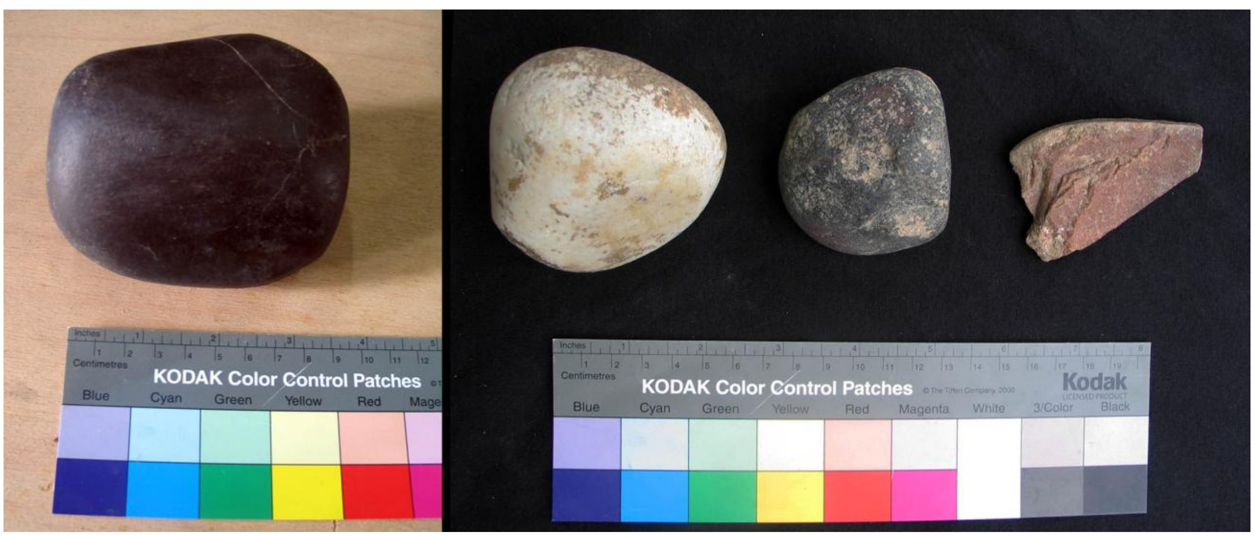


Figure 24: Water-shaped cobbles and cobble fragments from the Rakhigarhi grindingstone collection

One-hundred ten grindingstones (or around 16% of those examined) could not be assigned to any geologicformation and so were designated "source unknown." While most of these artefacts were composed of nondescript stone, some were made from very distinctive types of rock, such as the deep red variety of sandstone pictured in Figure 29. Given Rakhigarhi's relative proximity to the Gangetic Basin is quite possible

(though by no means certain) that many of the latter types were derived from sources on the western margins of that area.



Figure 25: Water-shaped cobbles of various kinds in the bed (left) and bank (right) of the Ghaggar River

Among the artefacts designated "source unknown" are a dozen roughly spherical-shaped stones that are metallic-gray in color and unusually heavy (two examples are pictured in Figure 30). A small sample was taken from a broken example and analyzed on a Rigaku Rapid II X-ray diffractometer (XRD) at the Department of Geoscience, University of Wisconsin-Madison. Its XRD spectrum indicates the material is *hematite* (iron oxide), which is a common ochre mineral. Although there are no marks (striations) visible on their surfaces that would indicated this, it is possible that these stones were powdered to make red ochre. Or they may have simply been heavy pounding tools. Hematite sometimes occurs as nodular masses and so the spherical form of these objects might be natural. On the other hand, they could be cobbles shaped by flowing water. Whatever the case may be, the geologic source of these stones is, at present, unclear.



Figure 26: Pab sandstone quern fragment (full view and detail) from Rakhigarhi

A picture of grindingstone acquisition at Rakhigarhi (Figure 31) is beginning to emerge. It can now be stated that site residents obtained the raw material for such tools from sources located roughly in each of the four cardinal directions. They relied most heavily on stone from the south in the Kaliana Hills, which were among the nearest sources to the city (outcrops in the vicinity of Tosham are slightly closer but the igneous rocks there do not seem to have been exploited for grindingstone material). A substantially smaller portion of the grindingstones used at Rakhigarhi seem to have been derived from riverbeds and/or alluvial deposits to the north of the site in the Himalayan Foothills region. Long-distance connections to the west are demonstrated by the presence of a handful of Pab sandstone querns from the Sulaiman Range while a few Mathura sandstone artefacts confirm links toward the Gangetic Basin in the east.

Although only a portion Rakhigarhi's grindingstones have been examined, some changes in raw material acquisition patterns over time seem to be evident. The two mounds from which the largest numbers of artefacts were examined are RGR-2 (n = 237) and RGR-6 (n = 228). The grindingstones examined from RGR-2 were from Harappan Period levels. RGR-6 is entirely an Early Harappan Period mound. Over 86% of the artefacts from RGR-6 are attributable to the Kaliana Hills while most of the remaining are from unknown sources. In contrast, just under 60%

of the stone in the Harappan Period levels of RGR-2 came from the



Figure 27: Pab formation in the Sulaiman Range, Pakistan (left) and detail of sandstone found there (right)

Kaliana Hills. Nearly 20% came from the Himalayas while the rest are Pab sandstone, Mathura sandstone or from unknown sources. So at Rakhigarhi there appears to have been a shift over time toward the acquisition of grindingstone from more diverse and distant sources. A similar (but even more pronounced) shift was detected at the site of Harappa between the Early Harappan and Harappan periods.

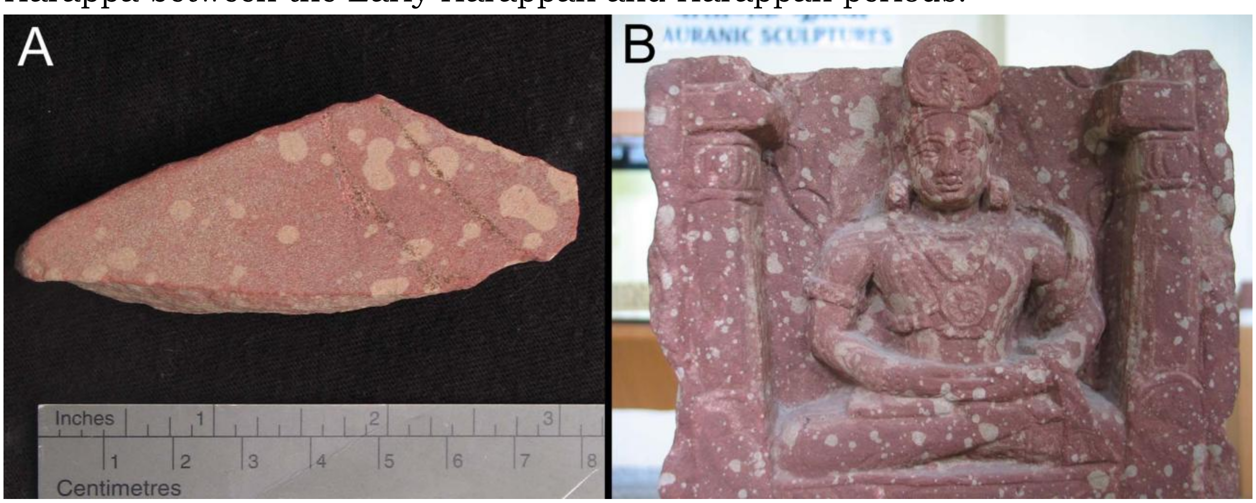


Figure 28: **[A]**Muthurasandstone fragment from Rakhigarhi and a **[B]** Muthura sandstone sculpture

Summary of findings and outline of continuing research

The Rakhigarhi stone and metal acquisition networks that have been identified thus far are summarized here and on Figure 32. INAA of steatite artefacts indicates that residents used raw material derived from deposits in northern Pakistan. INAA of agate-carnelian nodule fragments and manufacturing debris confirms that this variety of stone was being transported to the site from sources in Gujarat. Lead isotope assays of lead and silver objects suggest that these metals were obtained from deposits in southern Balochistan. Visual examinations of grindingstones has revealed that while multiple source areas were being exploited, the large majority of these objects are composed of rock occurring in southern Haryana. It is important to note that for each of these materials, save steatite, there are indications that other, presently unknown sources were also being exploited.



Figure 29: Saddle quern (left) and fragment (right) composed of a deep red sandstone of unknown origin

The data generated from the analyses conducted thus far, although limited, clearly show that residents of Rakhigarhi, like Harappans dwelling at other Indus cities, were participating in extensive inter-regional stone and metal acquisition networks. These networks are almost certain to become even more diverse as studies of the assemblage continue. One category of artifact found at the site that has not yet been examined is tools and debris composed of chert. When samples from such objects are compared to the INAA database of South Asian chert sources (Law 2011: Chapter 6), it is highly probable that a link from Rakhigarhi to the chert quarries in the Rohri Hills of Sindh will be confirmed. Similarly (and furthermore), it is our feeling that copper from

the northern Aravalli Range (i.e., the Khetri copper belt) and alluvial gold from rivers debauching the Himalaya foothills were probably traded via ancient Haryana to Harappan consumers across the Indus Civilization. If this was indeed the case, then it is very likely that these important metals first came to Rakhigarhi before being transported onwards.



Figure 30: Hematite cobbles/nodules of unknown origin Geologic provenience studies of

Rakhigarhi's stone and metal artifact assemblage are ongoing or in the planning stages. Larger numbers of agate-carnelian artefacts and unfired steatite artefacts are to be analyzed in order to confirm the acquisition patterns detected for these materials. A substantial set of chert artefacts is likewise to be subjected to INAA in order to determine if, like chert at other Harappan cities, a significant portion was being imported to the site from the Rohri Hills. The EDTA lead isotope sampling technique employed in this study is completely non-destructive and, in addition to lead and silver, can also be used to extract lead samples from copper artefacts. In 2013 most of Rakhigarhi's copper artefacts were sampled in this way and are being analyzed as this paper goes to press. The results will permit us to confirm or refute what has long been suspected – that the northern Aravalli Range was a major source area for Harappan copper. The study of the grindingstone assemblage will also continue until all those recovered have been examined. Doing so will permit us to fully examine changes in grindingstone acquisition patterns over time.

Lastly, a complete and detailed program of mineralogical identification

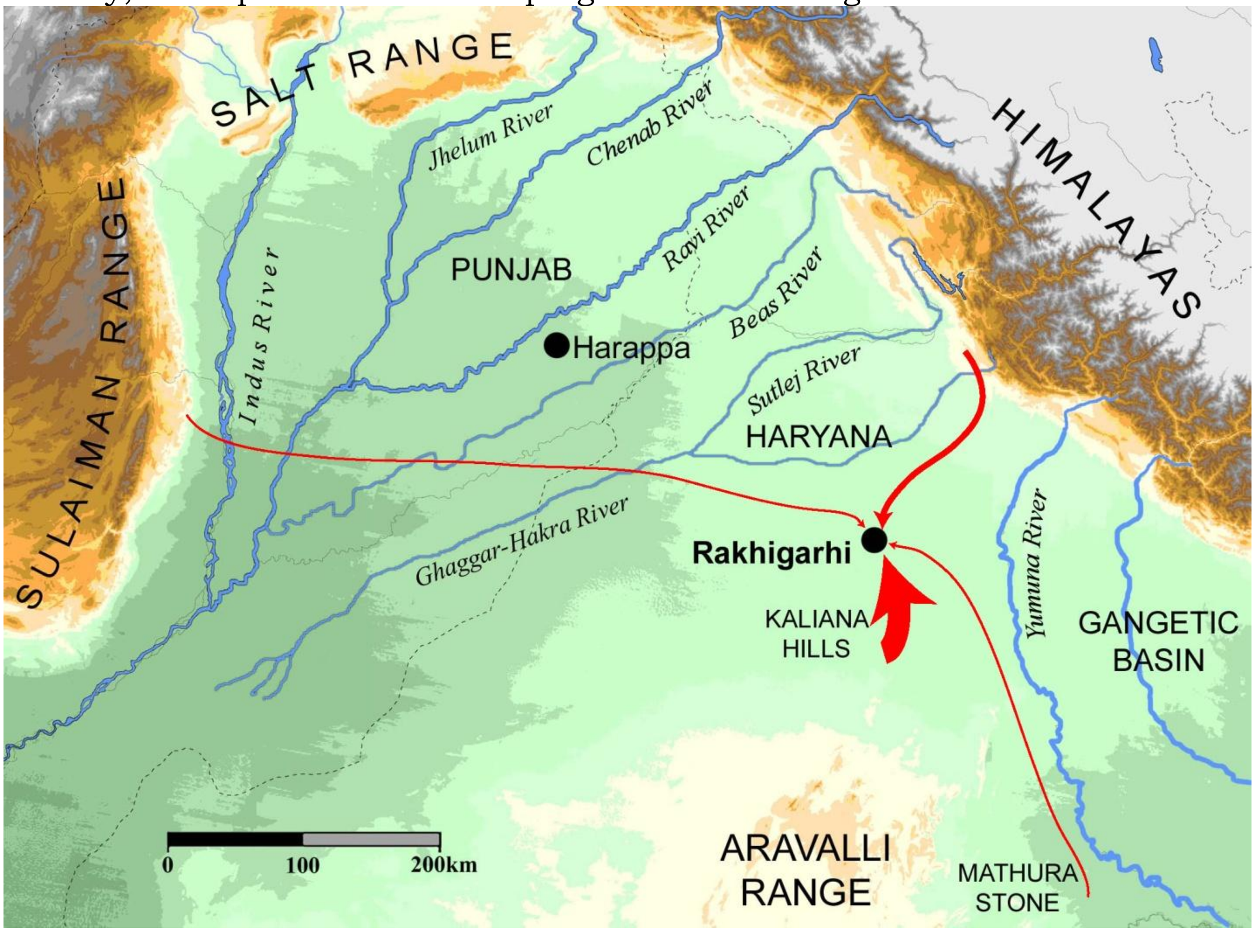


Figure 31: Rakhigarhi grindingstone acquisition networks

and inventory has been initiated. Rakhigarhi is one of the most important and unique Indus Civilization sites and a comprehensive examination of its stone and metal artifact assemblage is certain to shed new light on the issues of Harappan raw material acquisition and trade.

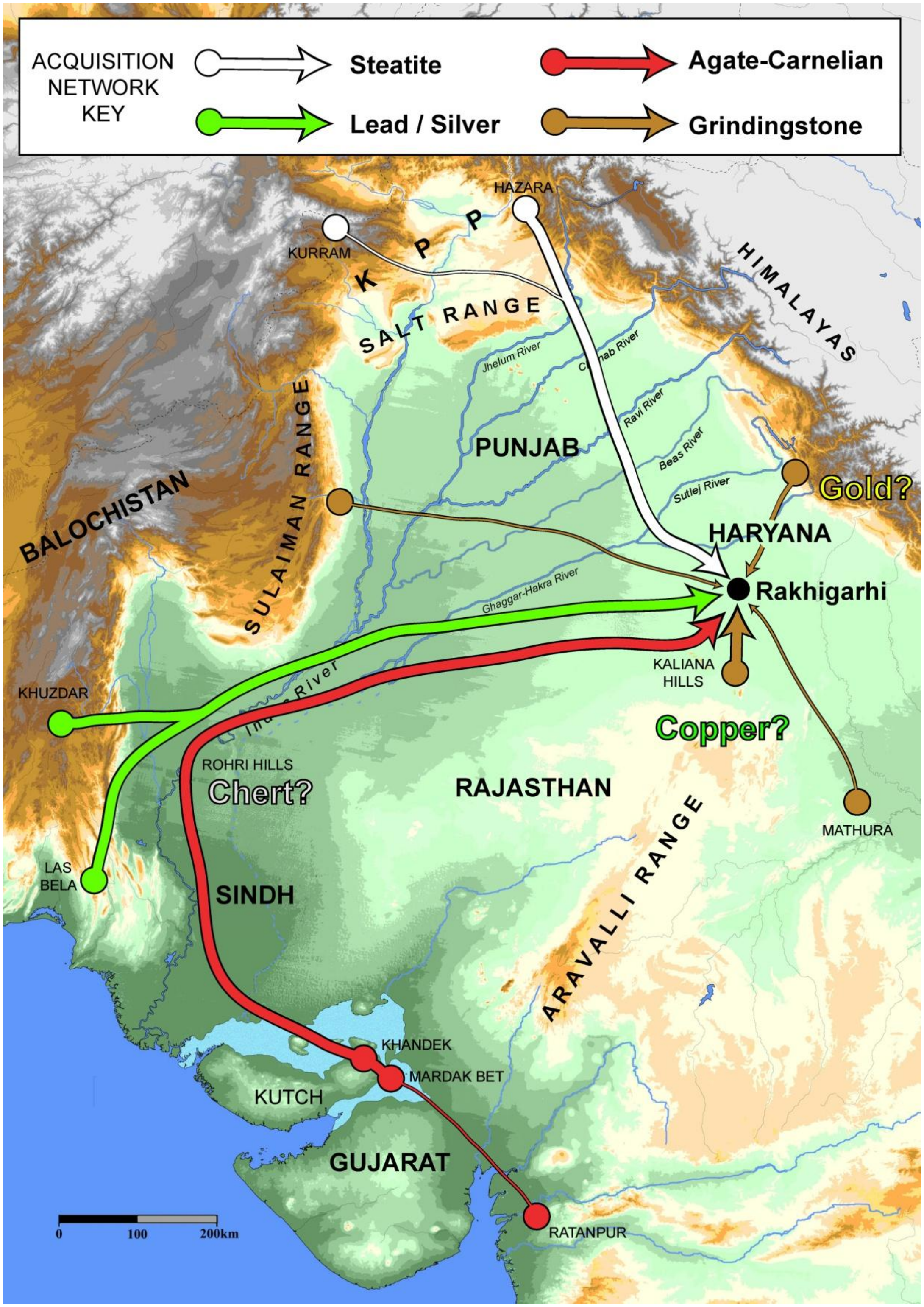


Figure 32: Rakhigarhi stone and metal sources and acquisition networks identified in this study. Potential, but as of yet unconfirmed, copper, gold and chert source areas are also indicated.

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